THE AEROPLANE and ASTRONAUTICS

JANUARY 15, 1960

EVERY FRIDAY
ONE SHILLING
AND SIXPENCE

"THE SEASLUG

...IS THE BEST THING THE NAVY HAS EVER HAD"

This was the opinion of the officer commanding H.M.S. Girdle Ness, the Royal Navy's guided weapons trials ship, after extensive trials in the Mediterranean. Commenting on Britain's first ship-to-air missile he added: "It is extremely accurate—a most excellent and necessary addition to the Fleet armoury." Extensive trials have been carried out on every part of the Seaslug system aboard H.M.S. Girdle Ness. Many missiles have been fired, scoring direct hits on target aircraft—though the Seaslug, which can engage bombers at maximum ceiling, need not score a direct hit to destroy its objective. The Seaslug is due to be fitted into four ships of the new County class. It has been designed and constructed by A.W.A. in collaboration with Sperry Gyroscope Co., Ltd., and The General Electric Co., Ltd.

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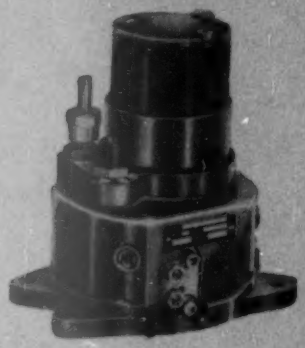
Smiths Aysynn Torque Pressure Indicator

A high accuracy remote pressure indicating system, operating from 115v. 400 c.p.s. A.C. supply. The indicator has a multi-turn concentric pointer presentation and is housed in a 2" square case with provision for integral lighting. Servo-operated, the indicator also houses the amplifier.



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MISCELLANEOUS

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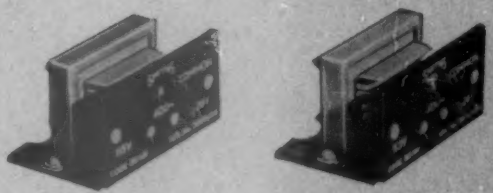

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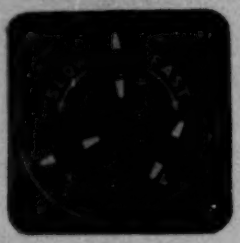


Kelvin Hughes Synchroscope

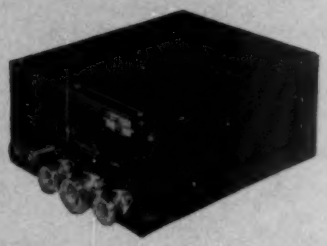
The four engine Synchroscope utilises three double ended pointers indicating the difference in speed between the "Master" engine and each of the remaining three. It consists of three separate Synchroscope Units, each of which in fact measures the frequency difference between its engine's generator and that of the "Master".

Smiths Temperature Indicator, Cylinder Head, Double Pointer

Designed for cylinder head temperature measurement of air cooled engines on twin or multi-engined aircraft, this double pointer instrument comprises two millivoltmeter moving coil movements with a common permanent magnet circuit. Each movement is connected via compensating leads with a thermo-couple built into one cylinder of each engine. Each movement embodies cold junction temperature compensation and two slotted buttons are provided on the front of the case for zero adjustment.

Smiths Temperature Indicator, Jet Pipe, Large S.A.E.

Specially designed to provide an accurate indication of jet pipe temperature over a scale of 250 angular degrees, this indicator is used in conjunction with chromel-alumel thermocouples. It can be supplied with a range of either 800° or 1000°C. The dial is "stepped" to avoid parallax errors.



Smiths Jet Pipe Temperature Control Amplifier

This amplifier is designed to protect a turbine engine from over heating of the turbine blades whilst allowing the engine to develop its maximum power. Signals from a thermocouple system are fed in, amplified and compared with a reference voltage. When the thermocouple output exceeds a pre-determined datum, the amplifier provides a signal to limit the fuel supply to the engine.

Smiths Temperature Indicator, Jet Pipe, Double Pointer

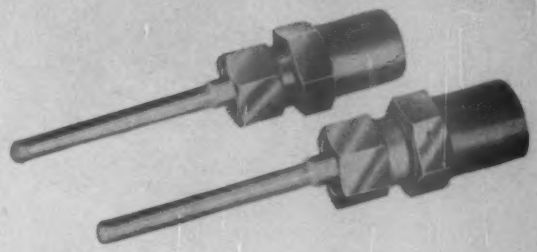
Designed for twin and multi-engined gas turbine aircraft. The two similar halves of the instrument operate independently in each jet pipe and are connected in parallel through suitable extension leads. The instrument face utilizes a platform scale and the pointers are arranged to be flush with the dial markings, reducing parallax errors.

Smiths Temperature Indicator, Jet Pipe, 2" case

Designed for use where panel space is limited, this indicator is supplied in a 2" hermetically sealed case with a special clamp for mounting. Terminal block connections are employed. It features a stepped dial with a scale of 250 angular degrees. Ranges, 0-800° or 1000°C.

Smiths Jet Pipe Temperature Indicating System, Servo Operated

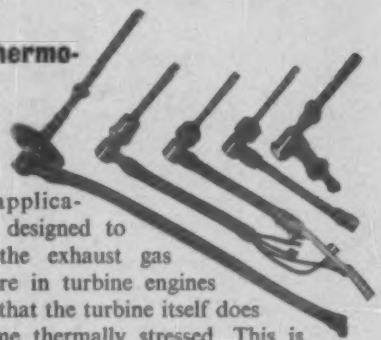
A light weight temperature indicating system comprising indicator, amplifier, cold junction unit and thermocouple network for operation from 115v. 400 c.p.s. supply. The Indicator has a graded scale for ease of reading in the region of take-off and cruise temperatures. Can be supplied in either 3½" standard case or 2" hermetically-sealed case.



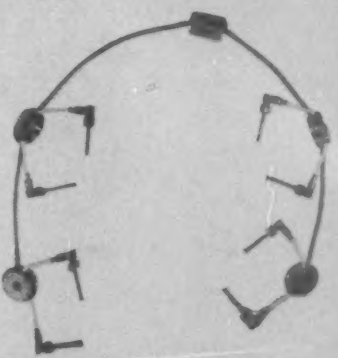
Smiths Thermo Bulbs

The thermometer bulbs illustrated are exceptionally robust in construction and are suitable for the measurement of liquid or gas temperatures up to 200°C. The design and materials used ensure quick response to changes in temperature.

K.L.G. Thermocouples



Thermocouples used in aircraft applications are designed to measure the exhaust gas temperature in turbine engines to ensure that the turbine itself does not become thermally stressed. This is done by using chromel and alumel wires joined together with their junction inserted in the gas stream. When this junction is heated a potential is produced proportional to the gas temperature. Illustrated are various types of probe used for obtaining stagnation or rapid response signals. Shown also are double and triple thermocouples employed where two or more separate signals are required, e.g., control amplifiers, streak detectors.

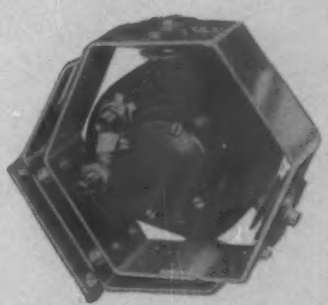


K.L.G. Thermocouple Harness

Thermocouple harness systems are now considered an essential part of engine equipment facilitating maintenance, reducing weight and providing installational advantages. These harnesses are designed for each specific application and provision is being made in current design for a further simplification by providing a harness with detachable probes leaving the basic harness attached to the engine.

Smiths 'Desynn' Torque Pressure Indicator

Smiths "Desynn" Torque Pressure Indicators are designed for use with transmitters of the type shown in the adjacent photograph. The indicators can be supplied in various ranges, and, with the transmitters, provide a robust and accurate measuring system for the vital indication of engine torque on reciprocating engines and propeller turbines.



Smiths 'Desynn' Torque Pressure Transmitter

Used in conjunction with the Desynn Torque Pressure Indicators, to provide an accurate remote indication of engine torque. Embodies a "Slab" Desynn which is designed to operate efficiently under vibration conditions and "g" effect. Operation is from 24v. D.C.

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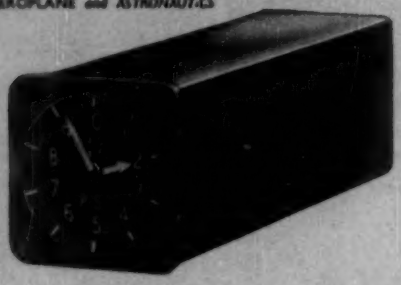

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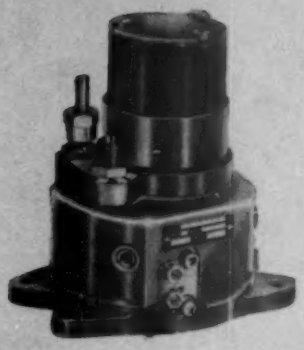

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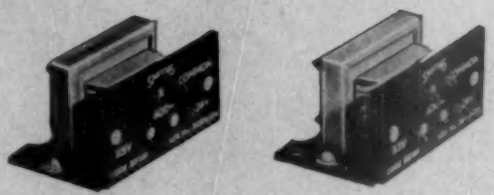

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AVIATION DIVISION

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Smiths Pressure Indicator, Inductor Type

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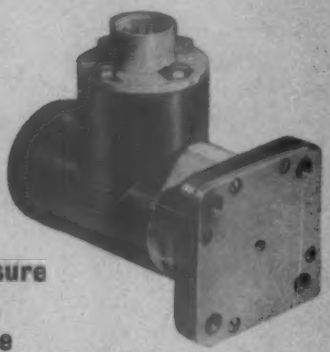

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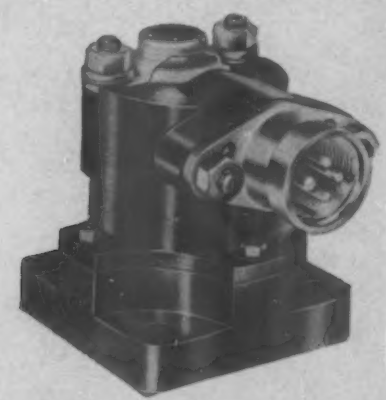

Smiths Pressure Switch

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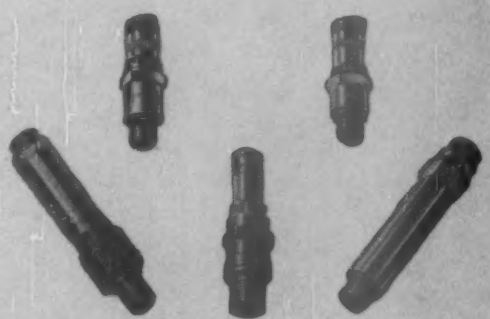

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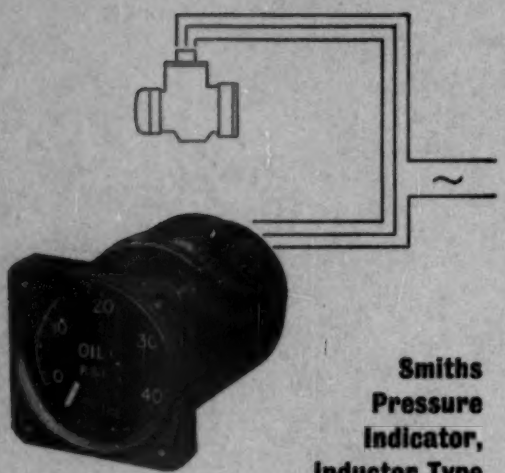

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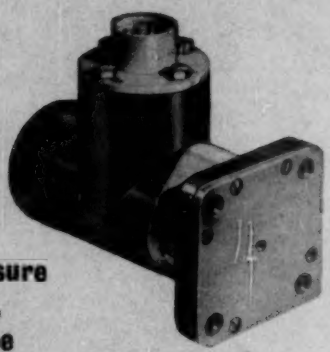

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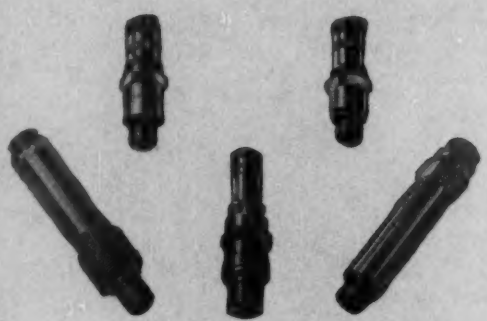

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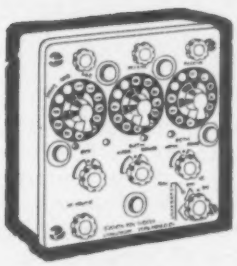
80% of British civil aircraft use ULTRA communication control equipment...



Ultra Communication Control System UA56 now in use in all BOAC's Comet IV aircraft.

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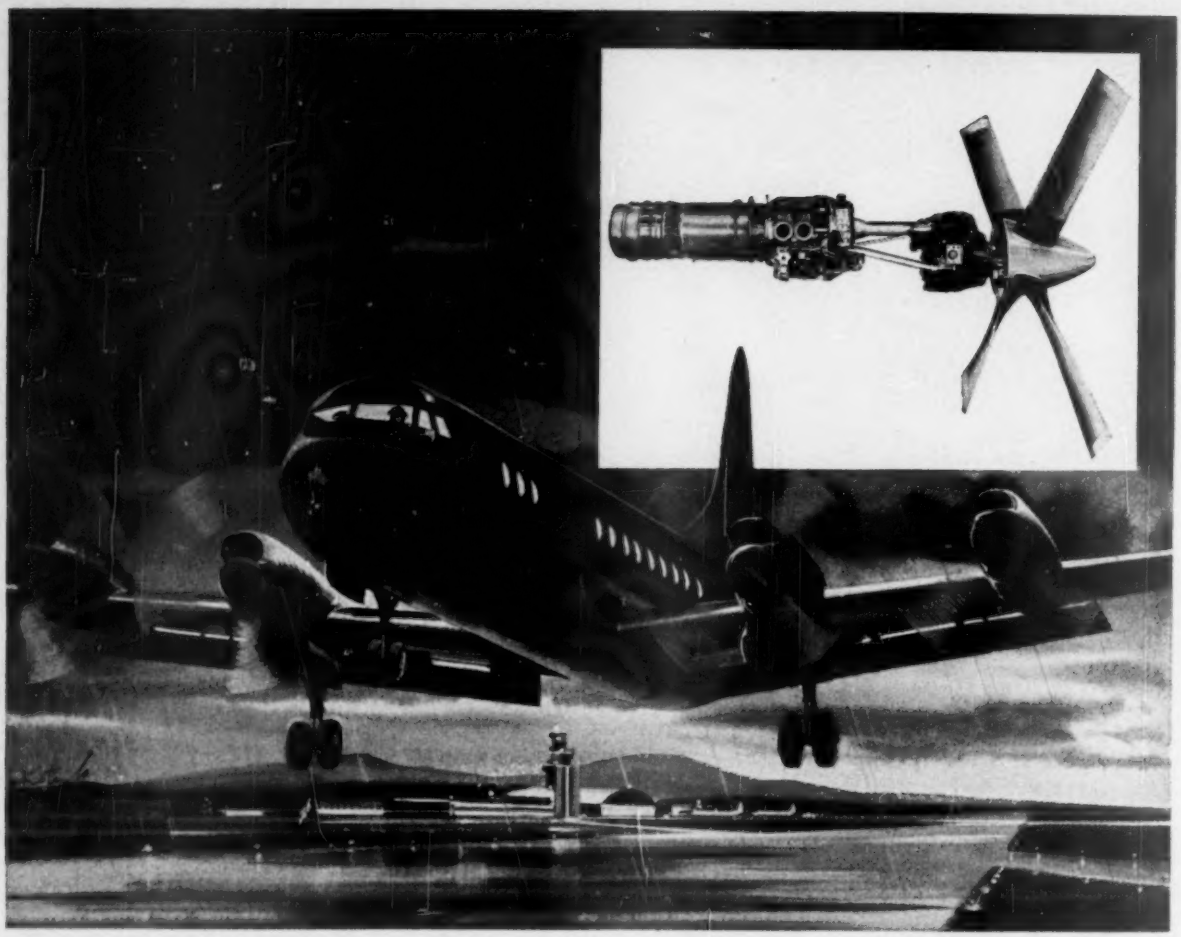

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Allison-powered Lockheed C-130

Allison-powered Lockheed Electra

Allison-powered Convair 340

ALLISON PROP-JET POWER

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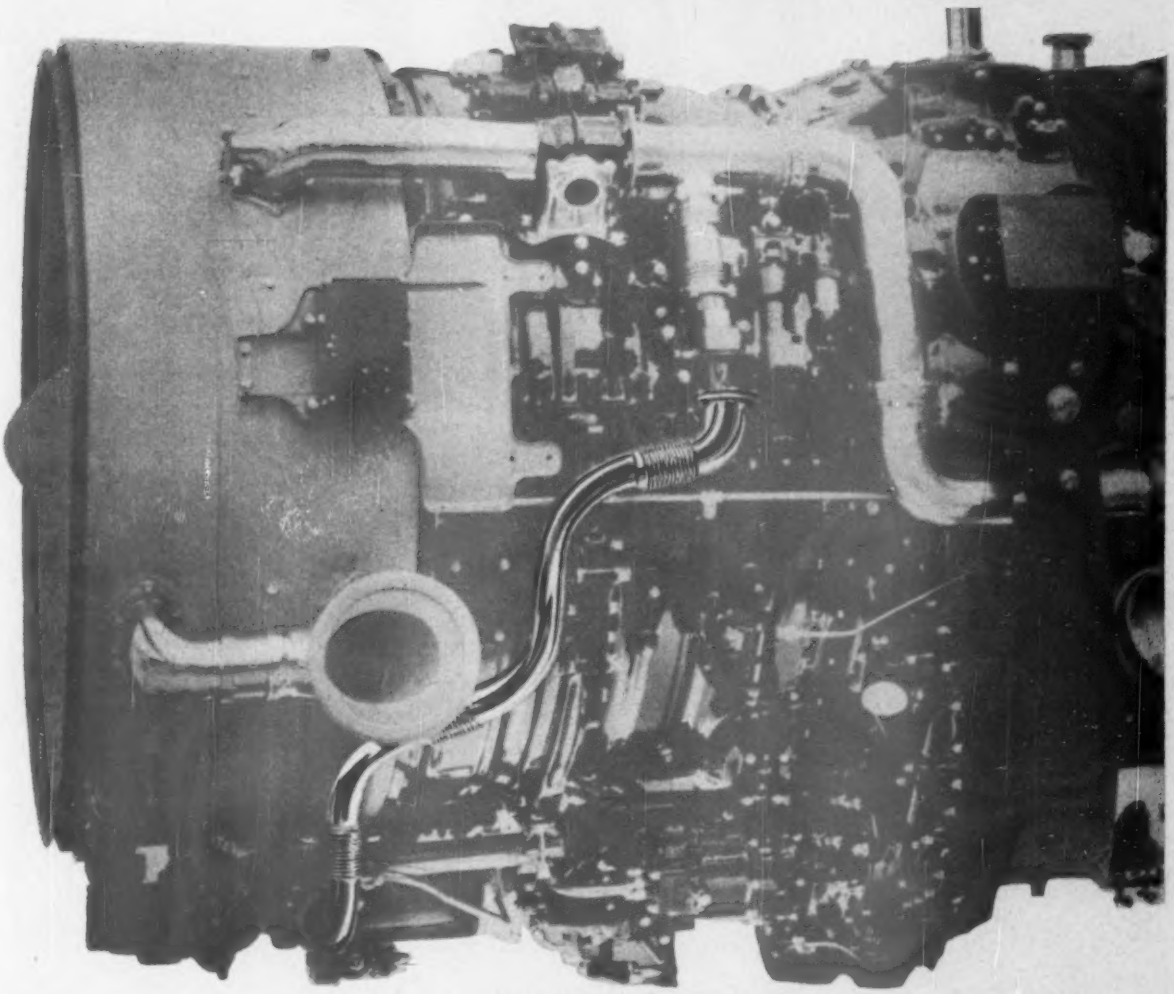
GM JET POWER

CORROFLEX on the CONWAY



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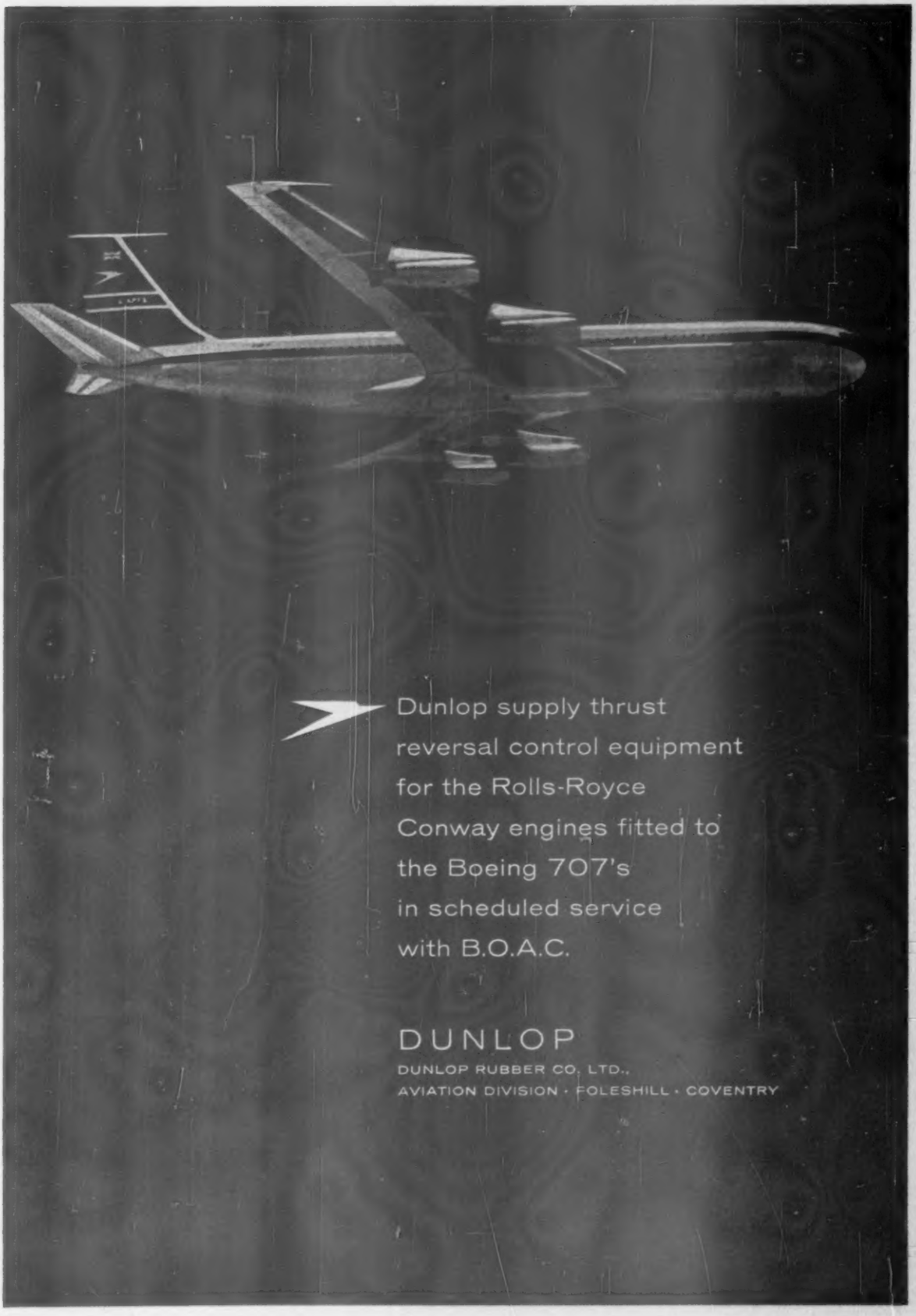
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for the Rolls-Royce
Conway engines fitted to
the Boeing 707's
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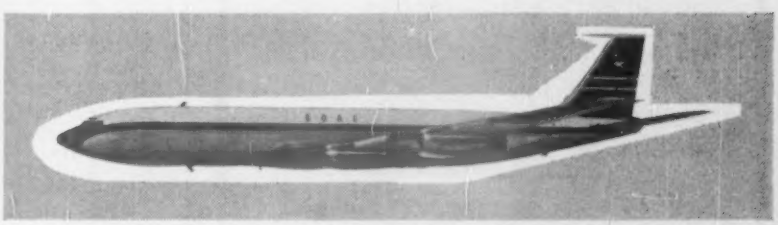

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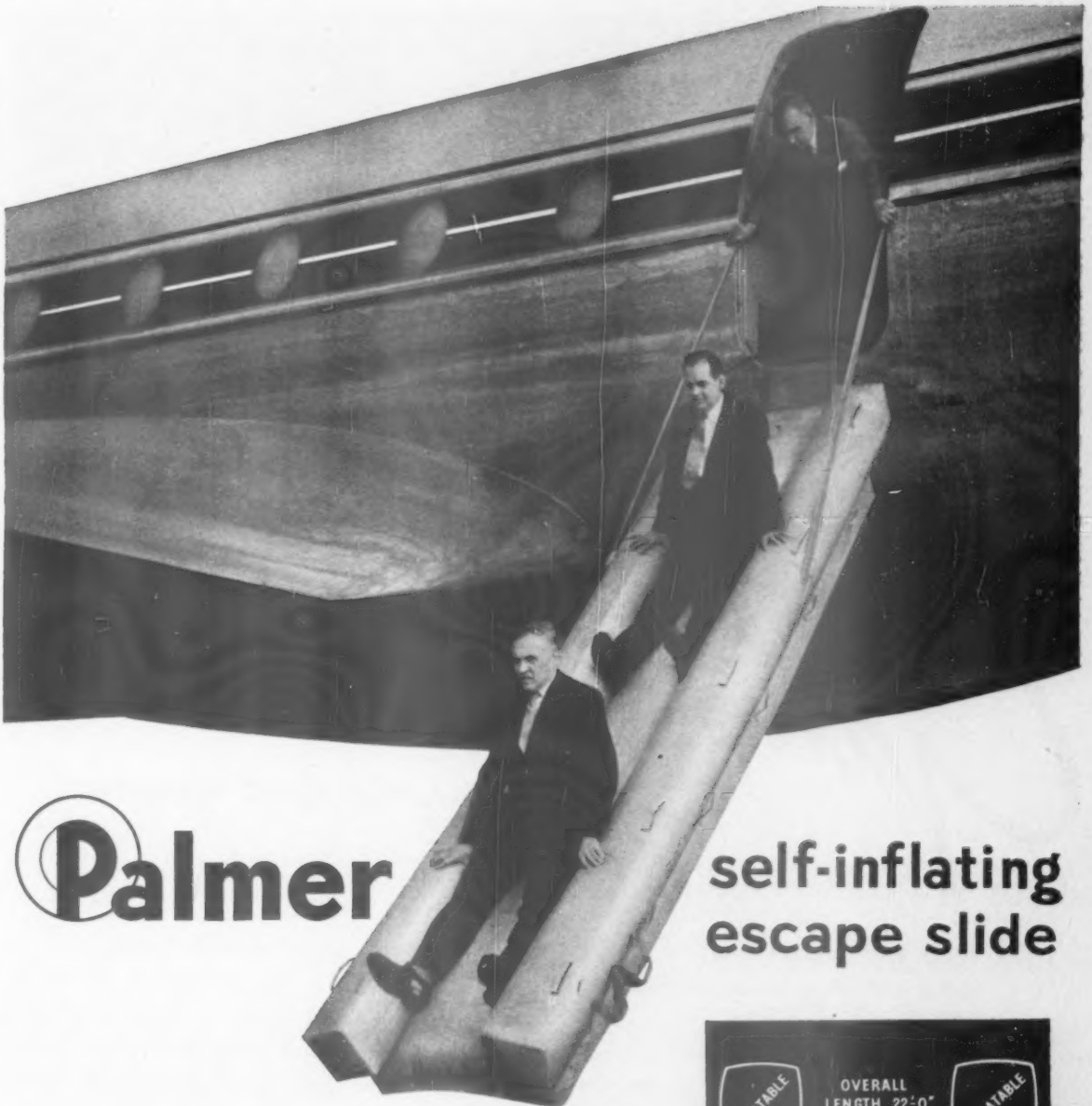

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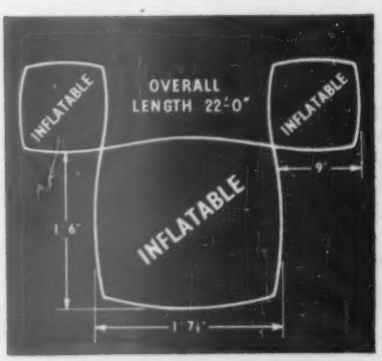

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THE AEROPLANE and ASTRONAUTICS

VOLUME 98 NUMBER 2517 JANUARY 15, 1960

The Challenge of the 'Sixties

On January 12, 1866, six men founded the Aeronautical Society of Great Britain: their special interest was dynamic flight. This year the Society, with more than 10,000 members and Royal since 1919, celebrated its ninety-fourth birthday with a luncheon given by the president and Council to 450 members and guests. An account of the reply given by Mr. Duncan Sandys to the toast of "British Aviation" proposed by the president, Mr. Peter G. Masefield, appears on p. 58.

In an article in the *Sunday Express* for January 10 Mr. Masefield emphasized the importance of the attitude which an enlightened British Government will take in the future towards the advancement of British aeronautics.

"We are pressing here," wrote Mr. Masefield, "on the frontiers of knowledge. The stimulus which the challenge of aviation has brought to the best scientific brains in the country has contributed substantially to our country's industrial progress—not only in aviation.

"We must ensure that our policy towards research, development, and the new technologies is as advanced as the scientific thinking. Unless we do so, these next 10 years will see the fruits of achievement going elsewhere—and we shall be the poorer.

"Upon these policy decisions depends whether the supersonic airliner of the 1970s is British or American. The nation which sparked the jet-engine, radar, and the radio telescope must accept the challenge of the 'sixties."

Railways and the Air

It may well be that the full benefits of aviation will not be forthcoming until complete integration is achieved between rail and air services. So long as aeroplanes require two-mile runways, so long will airfields have to be built far outside the cities they serve. Certainly it is no solution to push the ever-increasing loads of passengers onto the overcrowded roads and city streets.

Indications that some operators are talking with the railways about improvements in this direction appeared last week (see p. 62). But at present it is still too early to expect very much.

Some domestic air routes in this country were once run by the railways. In these days when the direct-lift machine, relying on jet thrust, is in sight as a challenge to helicopters, it is interesting to speculate how far the British Transport Commission might wish to go in taking advantage of the potentialities of the new machines. It is already clear from the news that the B.T.C. is interested in fixed-wing operations.

Hotels and Horse Sense

Air travellers who use London's airport have reason to give thanks. Last week the Skyways Hotel opened its doors for the first time. At last arriving or departing travellers at London Airport can obtain at any hour of the day or night a meal or a bed, or any of those services which help to ease the strain of long journeys made at high speeds.

If full advantage is to be taken of the expansion of air travel in the '60s, hotel accommodation must match every advance in airport and airline traffic. All praise then to the Canadian company which has taken the initiative in giving London Airport an essential hotel.

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Matters of Moment

Seeking Low-level Turbulence

A JOINT R.A.F.-Ministry of Aviation unit has been formed at El Adem, near Tobruk, Libya, to investigate the effects of high-speed low-level flights on aircraft structures and aircrew. A detachment from the main unit is also operating from Idris, near Tripoli, where it is hotter and more humid, and the terrain is higher.

The C.-in-C., Middle East Air Force, Air Marshal Sir William MacDonald, is in overall control of the trials, which are known as "Swifter." They are being conducted under the command of Sqn. Ldr. P. A. Thomson. Personnel from the Structures Department of R.A.E., the Institute of Aviation Medicine, Farnborough, and the Meteorological Office are also at El Adem.

Six modified Canberras are being used for the trials with aircrews drawn from M.E.A.F. squadrons. Special equipment fitted in the aircraft includes counting accelerometers, fatigue meters observed by automatic photographic observer units and a cold-air supply for the latest version of the ventilated flying suit.

Flights are to be made at heights between 100 and 600 ft., and day and night sorties of approximately two hours duration are to be flown over both land and sea. A total flying time of at least 1,000 hr. is planned for the unit during the 12 months that the trials will last.

El Adem was chosen as the base for trials because of its diurnal climatic variation, and valuable information for the assessment of operational requirements should be obtained. In addition to data on airframe fatigue life, instrument and radar display lay-out and flight control systems are being evaluated. On the human side, the Institute of Aviation Medicine is examining the effect of vibration and turbulence on crews and the efficiency of cooling suits and systems.

F-100s from France

FOLLOWING the French Government's refusal to permit the stockpiling of American nuclear weapons in France without sharing control of their use, three U.S.A.F. tactical wings have been redeployed to other NATO countries. First to arrive in the U.K. from France was the 10th Tactical Reconnaissance Wing, whose Douglas RB-66s are now based at Alconbury, Hunts. These were joined last week by the first of the 75 F-100D Super Sabres of the 48th Fighter-Bomber Wing, which began transferring from Chaumont to Lakenheath, Suffolk.

Transfer of the three squadrons was expected to be complete by last week-end, with the 1,000 or so personnel of the units airlifted by Douglas C-124 Globemasters, together with their equipment and, according to one newspaper, "at least 100 tactical nuclear bombs." The F-100Ds, and several F-100F trainers, each arrived with four very large underwing fuel tanks, and were said by their commander, Col. V. E. Warford, to be ready for instant action.

While in the U.K., they will form part of the U.S. Third Air Division, which normally comprises the 20th Fighter-Bomber Wing, of F-100s, at Wethersfield; the 81st Fighter-Bomber Wing, of F-101s, at Bentwaters; and the 47th Bomber Wing, of B-66s, at Sculthorpe. The 48th Wing had been in France since 1952, as part of the U.S. contribution to NATO. The remaining U.S.A.F. units in that country include two groups of transport aircraft and a wing of RF-101 Voodoos. The bases of Etain and Chaumont are being maintained by holding units for possible future use.

Super Accuracy

CRITICS of the long-range missile must have been astounded when President Eisenhower announced on January 7 that, in 14 recent test launches over ranges greater than 5,000 miles, the average miss-distance of the Atlas ICBM had been less than two miles. Even advocates of the long-range missiles must have been astonished at this accuracy, which means that with a thermonuclear warhead Atlas targets lie well within the area of total destruction.

This accuracy is better than original design requirements for the missile, which are believed to have specified a miss-distance less than ±0.1% of the range—equivalent to 5 miles at a range of 5,000 miles. It suggests that the Atlas now has an "overkill" capability.

Later U.S. missiles such as the Minuteman have smaller warheads and are designed for pin-point targets compared with the area targets intended for Atlas. They will be even more accurate than Atlas.

GUGGENHEIM MEDALLIST.—Sir George Edwards, managing director of Vickers-Armstrongs (Aircraft) Ltd., has been awarded the Daniel Guggenheim medal for 1959, and will receive it in New York on April 7 next. Interviewed by the B.B.C. in front of the original Viscount prototype (seen behind him) Sir George said, "We are getting on with the VC 10 now and making quite a lot of progress with it . . . I have little doubt that a family of aeroplanes will be designed round the VC 10 on which we're already working, actually a larger version to do the Atlantic with a lot more seats in it. And an aeroplane that in many areas will in fact serve as a replacement for the Viscount."

These revelations of Atlas accuracy have made it quite clear that with efficient modern guidance systems missile warheads can be landed very close to their targets. From this it follows that only small warheads will be necessary; the long-range missiles to propel them can be much smaller than today, and correspondingly cheaper; and in consequence the cost of the nuclear deterrent will be reduced. It has been suggested, however, that Atlas will still remain in service to be used if necessary for the obliteration of whole areas. Pin-point targets will be attacked by the small ICBMs.

Photographs of an Atlas launching and the operational warhead for this ICBM are on page 68 of this issue.

Next Steps in Space Research

FIRST outcome of the meeting of the international committee on space-research (COSPAR), which opened in Nice last week-end, was the return of Russian delegates to the forum of COSPAR discussions. Russia had boycotted this international organization since last March because of objections to the constitution, but a new constitution has now been drafted to the satisfaction of all concerned. Thus Russia again supports two international space-flight organizations, the International Astronautical Federation, which they joined in 1957, and COSPAR.

At the first COSPAR business session, Prof. H. C. van der Hulst, Professor of Astronomy at Leyden University, Holland, was elected President. Vice-presidents are Professor A. A. Blagonravov (leader of the Soviet delegation) and Dr. R. W. Porter, chairman of the Space Sciences Committee of the U.S. Academy of Sciences.

Following the business sessions, the first International Space Science Symposium opened at the Centre Universitaire Méditerranéen on January 11. Countries taking part in this Symposium are Argentina, Australia, Belgium, Canada, Formosa, France, Germany, Italy, Japan, the Netherlands, the Soviet Union, Spain, Sweden, Switzerland, South Africa, the United Kingdom, and the United States.

While the annual congresses of the International Astronautical Federation (I.A.F.) are concerned mainly with space-technology, the COSPAR symposium excludes propulsion and deals instead with tracking, telemetering, radiation belts, orbital variations, meteors, magnetic fields, ultra-violet radiation, cosmic rays, and other subjects of space-research.

British representatives numbering about 40 are led by Prof. H. S. W. Massey, F.R.S., chairman of the U.K. National

Committee on Space Research. Participants include those from university groups concerned in developing research instruments for the Skylark high-altitude rocket and the forthcoming American Scout satellite project, the R.A.E., the Royal Radar Establishment, the D.S.I.R. Radar Research Station, and other Government departments.

Among the 90-odd papers being presented at the Symposium, 11 are from Great Britain. According to Professor Blagonravov, there are 12 Russian papers, including one on the techniques used to photograph the Moon with Lunik III.

Anglo-American Gyroscopes

AN agreement has been concluded between Short Brothers and Harland, Ltd., of Belfast, and the Giannini Controls Corpn. of New York and Pasadena, California, whereby the American company is to manufacture under licence in the U.S.A. gyroscopes used in the Short Seacat anti-aircraft guided missile. These particular gyroscopes are driven by pyrotechnic charges contained within the rotor—a most ingenious feature that is claimed to give them a very quick start.

The rotor is, in fact, propelled by the exhaust gases escaping through tangential jets in its periphery. It accelerates to its maximum speed in approximately one-tenth of a second at normal ambient temperatures.

There are two versions of this Short gyroscope; a free gyro with two degrees of freedom and designed for roll stabilization, and a rate gyro intended for pitch and yaw rate of turn indications. This rate gyro contains two wire-wound pick-off potentiometers, one for telemetry and one for output signal. Each of these gyroscope units weighs 7 oz.

Co-operation in Outer Space

YET another example of the surprising way it is sometimes possible to gain a response from Russia outside the conference chamber came recently as a result of a letter addressed to Mr. Khrushchev by Mr. Victor Anfuso, an American Democrat. Mr. Anfuso proposed a bilateral agreement on the peaceful uses of outer space. And he received a reply from the Soviet Embassy stating that the Soviet Government was favourably disposed to the idea.

"If the Soviet Union receives definite proposals to start negotiations we will be prepared to express our attitude towards them," states the Russian reply. "The Soviet Union is ready to co-operate not only on a multilateral basis, as in the United Nations committee, but also on a bilateral basis when such co-operation is based on mutually advantageous conditions. As is known, the Soviet Union has already more than once made proposals on co-operation on outer space problems."

This exchange of letters followed a visit by Mr. Anfuso to Russia last autumn. Last year, at the United Nations General Assembly, the Soviet Union put forward a resolution that the U.N. should call an international scientific conference for the purpose of exchanging information derived from space explorations.

ON TO BOGOTA.—On Jan. 7 Britannia 312 turboprops of B.O.A.C. with 34 first-class and 39 tourist seats inaugurated a new 23-hour service from London to the capital of Colombia by way of Trinidad, Bermuda and Caracas.

Target Record

AN altitude record of a novel kind was claimed recently by the Radioplane company whose RP-76 rocket-powered, radio-controlled, target plane reached a height of 61,800-ft. over the White Sands proving grounds in New Mexico. It was air-launched by a jet-fighter.

This diminutive, transonic, pilotless aircraft, 9 ft. long and having a 5-ft. span, is propelled by a single rocket motor mounted amidships and fitted with twin exhausts emerging from behind the wings. Since this motor is of the end-burning solid variety, it is extremely reliable. One of the advantages of using rocket propulsion is that the speed performance increases with altitude; the RP-76 achieves Mach 0.94 above 60,000 ft.

Using new constructional methods, the airframe is built mainly of laminated glass-fibre plastics. There are no control surfaces on the wings or tail. Instead, the flying target is manœuvred by a canard system of vanes; these can be clearly seen in the photograph on page 68, beneath the U.S. insignia. The movable vanes are linked directly to the control receiver mounted in the fuselage nose.

Now that proving trials have been completed on behalf of the U.S. Army, the Radioplane Division of Northrop Corporation have received a $7,500,000 contract for the production of 400 of these high-flying targets. The contract also provides for a broad service programme in which Radioplane will fly target missions for the U.S. Army defence practice teams firing Nike-Ajax and Nike-Hercules surface-to-air missiles.

Soviet Space Plans

RUSSIA'S plans to test a powerful new space-booster and deposit the final stage in the central Pacific Ocean is dramatic evidence of the speed with which Soviet space-science is advancing. Last January, the President of the U.S.S.R. Academy of Sciences announced that the Soviet Union was pursuing a seven-year programme with the object of landing men on the Moon. This latest announcement suggests that the programme is well up to schedule.

The Russian statement, issued by *Tass*, said that test firings would be carried out between today and February 15. The place where the rockets are expected to impact is a comparatively small area lying approximately midway between the Hawaiian and Solomon Islands. Ships of the Soviet Fleet have been dispatched to the area to carry out the necessary measurements and "to ensure the safety of navigation and air traffic."

In explaining the reasons for the test programme, *Tass* said that "Soviet scientists and designers are now working to develop a more powerful rocket to launch heavy Earth satellites and undertake spaceflights to planets of the Solar System. With a view to perfecting this rocket with a high accuracy of flight, its launching without the last stage will be made within the coming months of 1960 into the central part of the Pacific Ocean removed from places of intensive shipping, airlines and fisheries."

Speculation on the nature of the new rocket is difficult in the absence of more precise information. The news does, however, raise the question of whether the Russians have already achieved a space-booster in the Saturn class—of 1 to 1½ million lb.s.t.

The suggestion that "heavy Earth satellites" will be launched

The Society's Ninety-fourth Birthday

NEVER can the chief protagonist at a ninety-fourth birthday party have seemed as youthful and as sprightly as did the *corpus* of that internationally famous body of the Royal Aeronautical Society show its corporate self to be at the anniversary party at the Dorchester Hotel in London on January 12. Yet there was present a due proportion of venerable names to whom the gathering was delighted to do much honour. There was the oldest living member, Brig.-Gen. Sir H. Osborne Mance, who joined in 1899, there was Lord Brabazon, owner of No. 1 flying certificate, Sir Thomas Sopwith, holder of No. 31, and Dr. A. Peter Thurston who looked just as vigorous as when he worked on Sir Hiram Maxim's flying machine at the turn of the century.

There was universal regret that illness kept away Sir Frederick Handley Page, doyen of aircraft constructors and notable individualist; it was the guest of honour, the Minister of Aviation, Mr. Duncan Sandys, who proposed, and was supported with acclamation, that a message of good wishes for recovery should be sent to "H.P."

It must be a long time since so many of those truly devoted to aviation as a cause have gathered in one place. As a result there was a oneness of interest and awareness of achievement which it would be very hard to repeat. In such an atmosphere it is not surprising that the President of the Royal Aeronautical Society, who has made many brilliant public speeches, should have excelled himself. He is a master of mixing the literary allusion with the irreverent modern wisecrack.

MR. PETER MASEFIELD found quotations from Shakespeare to fit the Minister by Christian name and a quotation from Rudyard Kipling in a letter to General Maitland soon after the first ever crossing of the Atlantic by air (in a British airship) to suit modern times. He spoke about the splendid new hall which the Society has brought into being and he spoke about Man-powered Flight. In particular he welcomed Mr. Kremer who has given a prize of £5,000 for competition in this exciting field of endeavour.

MR. DUNCAN SANDYS wasted no time in explaining to the gathering that he did not propose to enlarge on the subject of mergers, though he did allow his hearers to gain the impression that he was not altogether dissatisfied with his rôle as obstetrician at the successful births of two new groups in the aircraft industry.

He set himself to outline the present scope of aviation particularly in the civil field. He had previously been careful to explain that his White Paper on Defence had been largely misinterpreted and that there should never have been any doubt, and he made it clear that he never had any doubt, that there would always be, as far as one could see, a future for the manned military aircraft.

He made it clear, and asked his audience to show their approval of his declaration by applauding, that the Government were going to support civil aviation. Consequently it was interesting, and many will believe significant, that the Minister then outlined the case, as we have so often done in our pages, for the supersonic airliner. If the Government have decided to support a British effort here, then the British aircraft industry indeed has a worthwhile undertaking on which to concentrate for the years immediately ahead.

Finally, Mr. Sandys spoke of rockets. One gathered that it would officially be regarded as early days to reach any decision about space exploration until it can be known whether this country has a successful ballistic missile of its own or not. However, it was not lost on his audience that the Minister outlined the potentialities of that combination of Blue Streak with Black Knight about which we have so frequently written in our Astronautics section. Mr. Sandys pointed out that this combination with a third rocket could put a 2,000-lb. satellite in orbit round the Earth or drop 200-lb. on the Moon.

No wonder if at the end of such a talk after a ninety-fourth birthday lunch some of the older members were becoming a little dazed. Even if one has lived through the whole of the wonderful first 50 years of powered flight in Great Britain, it still staggers the imagination to hear serious talk of putting teams of explorers into space. The younger members of the Society, of course, require no such feat of imagination. To them it is a question of planning. However, before the deed is done, it will certainly require an act of faith on the part of the whole British people.

Continued from page 57

with the new rocket, using an additional top stage, strongly supports the view that the Russians are preparing the way for manned space-flight, possibly to follow more experiments with dogs, this time in recoverable satellites. The payload capability of the new rocket will almost certainly be sufficient for it to engage in experiments with boost-gliders and robust orbital aircraft of the type now being studied in America under the U.S.A.F. Dyna-Soar project.

In the realm of space exploration, the same basic booster should permit heavy payloads to be dispatched into orbit around the Sun, possibly containing sufficient guidance equipment and propulsion devices for performing mid-course corrective manœuvres for reasonably close interceptions of the nearer planets.

The Second Major Move

WITHIN a month of the announcement concerning the first of the major mergers within the aircraft industry, has come news of another. Last week's headline news confirmed that the expected combination of Vickers-Armstrongs (Aircraft), English Electric Aviation and Bristol Aircraft had been formed with these three companies as wholly owned subsidiaries of a new joint company—the name of which has yet to be announced. Its components will hold shares in it in the proportions—Vickers 40%, English Electric 40% and Bristol 20%.

According to the official statement made by the three companies, financial responsibility for types of aircraft and missiles already in production will remain with the appropriate principal company, namely Vickers, Ltd., English Electric Co., Ltd., or The Bristol Aeroplane Co., Ltd. The statement also said that the new company's board will control policy and will be comprised of directors from the three principal companies and from the three subsidiaries. These three subsidiaries will retain their own names and identities and will be responsible for day-to-day operations.

One important aspect of this particular arrangement is that Bristol's helicopter interests are not included in the merger. These have been the subject of a separate negotiation and will be acquired by Westland Aircraft, which recently bought Saunders-Roe and now becomes Britain's principal group specializing in helicopter design and production.

Negotiations are also taking place between the new Vickers/English Electric/Bristol combine and the Hunting Group with a view to the participation of Hunting Aircraft in the new company.

Investigating "Galactic Noise"

IN the early hours of December 22, a four-stage rocket was launched from Wallops Island, Virginia, in a joint endeavour by United States and Canadian scientists to investigate "long-wavelength" radio noise from space. A second purpose of the firing was to test the X-248 solid-propellent rocket engine which has been developed from the Vanguard third stage for the new Delta space-booster and the Chance-Vought Scout.

The 48-ft. Javelin test-vehicle was programmed to carry the research payload to an altitude of about 560 miles. It consisted of an Honest John and two Nike boosters as well as the X-248 motor which formed the top stage. Total launching weight was about 7,000 lb. The 48-lb. payload contained a three-megacycle radio-receiver and a telemetry system which relayed the galactic radio signals to ground stations.

The fact that the longer wavelength background radiation of the Galaxy is absorbed by the ionosphere makes it necessary for measurements to be carried out at altitudes above approximately 450 miles. In the future, experiments of this kind are likely to be carried out with artificial satellites.

Telemetry stations for the experiment were located at Wallops Island, Cape Hatteras, North Carolina, and Cape Canaveral, Florida. A few hours after the launching, the National Aeronautics and Space Administration announced that the final-stage rocket fell into the Atlantic about 600 miles from the launching point about 18 minutes after firing.

Nevil Shute Norway

IT is with great regret that we record the sudden death in Melbourne, Australia, of Nevil Shute Norway, B.A. (Oxon), F.R.Ae.S. He was closely associated with British aviation from 1922 onwards and was widely known as Nevil Shute—author of a large number of novels having an aviation background.

Born on January 17, 1899, Nevil Shute Norway served in the Army in the First World War and in 1922 joined the de Havilland Aircraft company as a calculator. He later joined the team responsible for the design of the R.100 airship and became deputy chief engineer in 1928. He founded the Airspeed company in 1931, joined the R.N.V.R. in 1940; retired in 1945; and later went to live in Australia.

General Aviation News

STILL GOING.—Sputnik III, which has lasted longer than predicted, has now completed 8,600 orbits of the Earth, covering a distance of over 239 million miles.

RADAR TRAINING.—Decca Radar, Ltd., is to establish a radar training school at Cowes Airport, a recently acquired site which is being developed by the company to provide additional manufacturing capacity. Planned to be completed next spring, the new school will provide technical training for engineering and servicing personnel. Decca Radar already operate a technical training unit in London.

I.A.F. CONGRESS.—The British Interplanetary Society has announced that the 11th Congress of the International Astronautical Federation will be held in Stockholm during the week August 15-20, 1960. The main sessions of the Congress, which is being organized by the Swedish Interplanetary Society, will take place at the Royal Institute of Technology. Persons and organizations wishing to receive further information are invited to write to the Congress Secretariat, I.A.F.-60, Box 5045, Stockholm, 5, Sweden.

CATS AFLOAT.—It has now been announced that Swedish naval vessels will be equipped with Short "Seacat" SAM missiles in 1961. Last month, it was disclosed that Shorts had received an order from the Swedish Admiralty for a number of these missiles for evaluation.

TYNE APPROVAL.—The A.R.B. has given full normal category approval for civil operation of the Rolls-Royce Tyne RTy. 1 Mk. 506 and the Tyne RTy. 11 Mk. 512. The engines, which deliver 4,985 and 5,545 e.h.p. respectively, are in production for Vickers Vanguards ordered by B.E.A. and T.C.A. Tynes also power the Canadair CL-44 transport and have been selected for the Short Britannic 3, the Fairey Rotodyne, the Breguet 1150 and the Transail 160.

MiL EXPORT.—A Russian Mi-4S helicopter has been purchased by a group of Austrian and Swiss hotel owners to carry passengers from airports to clearings close to the hotels in the mountains, and for freight carrying during the off-season months. Powered by an ASh-82V radial engine, this 16-passenger helicopter is the first sold by Russia outside the Communist bloc for civil use.

NEXT WEEK

TO mark the inauguration of the B.O.A.C. Comet service across the South Atlantic on January 25, a special Latin-American issue of THE AEROPLANE AND ASTRONAUTICS will be published on January 22 at the usual price of 1s. 6d. Copies flown by Comet to countries along the route will contain appropriate Spanish and Portuguese supplements.

AIRBORNE BOOST.—A test programme to determine the feasibility of air-launching high-altitude sounding rockets is being conducted by Air Research and Development Command. Three-stage solid-propellent Jaguar rockets are designed to reach heights of up to 600 miles after vertical release from a Martin B-57.

U.S. CARAVELLES?—Following news of a Caravelle purchase by General Electric (our previous issue) come reports from Paris that a licence for production of the Caravelle by Convair is being discussed. With CJ-805-23 turbofans—as used in the Convair 600—the Caravelle would allow Convair to compete with the proposed Douglas DC-9 and Boeing 727 in the U.S. short-haul jet market.

LEYSDOWN REOPENING.—The historic area of Mussel Marshes, Leysdown, in the Isle of Sheppey, where Lord Brabazon qualified for the first British pilot's certificate, is likely to be used as an airfield once again, for the operation of light aircraft. Short Brothers, the original operators, have been given planning permission to use 77 acres for this purpose and are awaiting M.o.A. licensing approval for club and pleasure flying. Leysdown could also be useful for Short's new S.C.7 project, and is likely to reopen by Whitsun.

DRAKEN TRAINER.—A two-seat version of the Saab Draken supersonic fighter made its first flight in December. Powered by a Rolls-Royce Avon it is designated J 35C and with the exception of the front fuselage is identical with the J 35A single-seater.

RAPEC TESTED.—The U.S. Navy has announced the successful testing of a new rocket ejection system, codenamed RAPEC (rocket-assisted personnel ejection catapult). This system has been developed over the past two years at China Lake, and has demonstrated its capability of ejecting a 300-lb. mass 200 ft. in the air, to meet the ground level case.

U.S./FRENCH ENGINES.—SNECMA and the United Aircraft Corp. have signed an agreement whereby United will acquire a 10.9% interest in SNECMA and the French company will obtain licences to manufacture Pratt & Whitney engines. The licence covers the J57, the J75, and JT3D-1 and -3 turbofans, the JT12A and the complete range of Pratt & Whitney piston engines and spare parts.

MACH MODEL.—An 18-in. model of a winged hyper-velocity boost-glider has been launched successfully at Holloman Air Force Base in New Mexico. Devised by Boeing Airplane Company, the experiment was unconnected with the Dyna-Soar project. A modified three-stage rocket developed by the Santa Barbara Division of the Curtiss-Wright Corp. was used for launching.

D.H. AUSTRALIAN NEWS.—One of the Australian Government's biggest aircraft factories at Lidcombe, N.S.W., has been taken over by de Havilland Aircraft Company of Australia. It is to be used for all the company's engine overhaul work now done in three separate plants and will also be tooled for manufacturing a number of new non-aeronautical D.H. products.

BRISTOL VISITORS.—Gp. Capt. J. Pelly-Fry (right), Civil Air Adviser designate, Melbourne, and Mr. E. I. R. McGregor, Civil Air Attaché designate, Washington (left) visited Bristol Siddeley Engines, Ltd., recently. With them here is Mr. J. L. Milner of the company's Aero Sales Department.

JORDAN AIR STRENGTH.—Air Marshal Sir William MacDonald, C.-in-C., Middle East Air Force, has recently had talks with the Jordan Prime Minister. The C.-in-C.'s visit to Amman is understood to be a prelude to the strengthening of the Royal Jordanian Air Force.

ANTARCTIC LOSS.—Two R.A.A.F. Beavers were destroyed when a 120 m.p.h. hurricane recently hit the Australian Antarctic base at Mawson. Sqn. Ldr. J. Sandercock, R.A.A.F., saved one sliding aircraft by climbing in the cockpit and starting the engine to hold it into wind for more than two hours.

LOCKHEED IN EUROPE.—Lockheed Aircraft International, a new wholly owned Lockheed subsidiary, has acquired an important interest in Aeronautica Macchi, S.A., near Milan. As part of the agreement, Aeronautica Macchi are to produce the new Lockheed light utility aircraft in Italy. The aircraft, which made its first flight at the company's Georgia Division last September, is an all-metal STOL high-wing transport capable of carrying six persons or approximately 1,100 lb. of freight. Macchi has overhauled T-33s since 1957.

A TACTICAL MOVE.—Complete with flight refuelling probe and massive underwing tanks, the F-100D and F-100F Super Sabres of the 48th Fighter-Bomber Wing arrived last week at Lakenheath from Chaumont, France.

SPUTNIKS AND SHOES.—Full-scale reconstructions of the Soviet artificial satellites and space-probes will be included in a Russian trade exhibition at Earls Court from July 7 to 29, 1961. A similar British exhibition in Moscow from May 19 to June 4, 1961, "will include examples of British-made women's underwear, shoes and woollen goods."

SPACE RAYS.—Describing the structure of the outer radiation belt, Prof. Sergei Vernov, said recently that with the help of Sputnik III and Soviet "space rockets," it had now been proved that it consists of two main components—electrons of relatively low energy of up to 10,000-100,000 electron volts, and high energy electrons of up to 3-million electron volts.

Commercial Aviation Affairs

CHEAPER TO PARIS. — Skyways (Coach-Air) will cut fares on its coach-air services to Paris from April 1, and will speed up the service to 5½ hours overall, centre-to-centre. New return fares will be £5 10s. night excursion (90 days); £6 10s. day excursion (30 days); £9 5s. mid-week (30 days); and £10 15s. week-end and day standard (12 months). Peak daily frequency will be increased to 18 from 12.

B.O.A.C. PACIFIC SERVICES.—From March 17, B.O.A.C. will operate a third weekly Britannia service between San Francisco and Hong Kong via Tokyo. This service will originate and terminate in San Francisco; like the two through services from London it will offer 20 first-class and 40 tourist seats in each direction.

DIVIDED ENGINE OVERHAUL.—The F.A.A. has approved a sectionalized overhaul system for General Electric CJ805-3 engines in the Convair 880. The "cold" sections, aft of the rear compressor frame, will have an initial overhaul period of 1,600 hr. while the "hot" sections will have an overhaul interval of 900 hr.

IRISH TRAFFIC.—During 1959, Irish Air Lines carried 578,000 passengers, an increase of 13.5%. The total included 23,000 passengers on the transatlantic service—77% more than in 1958, the first year of operation.

ELAND-CONVAIR PLANS.—Napier Engines Inc., of Washington, has purchased nine Convair 340s from United Air Lines to provide a stock of Eland-powered Convair conversions from which immediate delivery can be offered. Allegheny Airlines has purchased 11 Convairs from Lockheed Aircraft Corp. and four will be converted to Eland power immediately. Allegheny will also purchase the Eland-Convair 440 demonstrator which it has leased since last July (see our issue for December 4) and has leased the original Eland-Convair 340 conversion for immediate use on its routes.

AEROFLOT JET SERVICES.—Turbojet or turboprop services will be extended to many routes by Aeroflot during 1960. One of the first, introduced on January 4, is an Il-18 service between Moscow and Ashkhabad, reducing the journey time from about 10 hr. to 4½ hr. On the following day, Il-18 service from Moscow to Bucharest and Sofia was inaugurated. Vienna and Berlin will have jet service from Moscow soon.

ATC COMPUTER.—An IBM 650 RAMAC computer at Indianapolis Air Route Traffic Control Center has been linked with similar equipment at Washington, Cleveland and Pittsburgh, as part of the F.A.A. plan to install computers at 30 centres throughout the U.S.A. by 1965. The computers receive flight plans and flight messages from teletype lines and forward flight progress strips to other centres.

PAN AM. PROPOSALS.—Proposals designed to "create a strong American-flag route pattern capable of competing effectively with foreign-flag airlines," have been made to the C.A.B. by Pan American. If the proposals are approved they would make possible a 20% cut in passengers' fares and 62.5% in cargo rates, says the company. It wishes to extend its Far East services to cities east of the Mississippi; include Seattle and Portland on the Great Circle route to Tokyo; fly from Tokyo to Manila via Okinawa instead of Hong Kong and include Tahiti on the southern Pacific route.

WARSAW BAN.—Poland has refused permission for B.E.A. to operate its Comet 4Bs on the London-Warsaw route "for commercial reasons." The Polish airline LOT uses Convair 340s on the reciprocal Warsaw-London service.

K.L.M. IN 1959.—Carrying over a million passengers in a year for the first time, K.L.M. increased its passenger traffic by 15% in 1959, for a 13% increase in C.T.M. Freight went up by 20% and mail by 11%. Inclusive tour traffic went up by 50% overall, with a 125% increase in Europe.

RISING TIDE.—More than four million passengers used London Airport in 1959—an increase of some 17% over 1958. Aircraft movements, however, went down by about 2% to 127,000, as a result of larger-capacity aircraft coming into service.

DC-8 DELIVERIES.—In the first three months of 1960, initial deliveries of the DC-8 will be made to 10 more airlines—Alitalia, Eastern, K.L.M., National, Northwest, Pan American, Panagra, S.A.S., Swissair and T.C.A. To date, only Delta and United have initiated DC-8 service. More than 100 of 152 DC-8s on order will be delivered by the end of 1960.

AFRICAN MERGER.—Hunting-Clan African Airways and Air Carriers of Rhodesia have merged their interests in a single company known as Hunting-Clan Air Carriers. The new company, under Mr. Coleman Myers (former director and general manager of Air Carriers) will concentrate its attentions on developing charter work and facilities for tourists in the Federation of Rhodesia and Nyasaland.

TWO MILLION IN THE 707.—In 14 months of airline service, Boeing 707s have now carried two million passengers. More than 80 are in service and 100 have been delivered.

NEW ORDERS.—T.H.Y. Turkish Airlines has ordered 10 F-27 Friendships—five each from Fokker and Fairchild. The U.S. company's participation in this order is attributed to the financing

arrangements made by T.H.Y. The Indian Airlines Corporation order for F-27s is expected to be confirmed in the near future, and Lufthansa will sign a contract for "three to five" Boeing 720Bs later this month. Western Air Lines has ordered three more Electras for a total fleet of 12. Japan Air Lines is to purchase a fifth DC-8.

WOOLSINGTON TERMINAL.—Newcastle upon Tyne municipal airport committee has approved a scheme to erect new terminal buildings at Woolsington Airport at a cost of £700,000.

N.Z. AIRPORT.—Dunedin, New Zealand, is to have an airport at Momona. The Government and the City Council have agreed on this, a tender has been accepted, and construction costs will be shared equally by the two parties.

PHILIPPINE AIRPORT.—A new international airport is to be built on Mactan Island, in the central Philippines, to supplement Manila Airport. The U.S. International Co-operation Administration is sharing in the $12.5 million cost. Completion is scheduled this year.

VISCOUNT INCIDENTS.—A B.E.A. Viscount was severely damaged by fire at London Airport on January 7 while taxi-ing to the terminal after arrival from Dublin. The nosewheel collapsed and the fire was started by sparks when the fuselage rubbed along the ground. All 59 occupants escaped safely before the fire took hold of the fuselage; the wings, engines and fuel tanks remained intact. In another incident on January 5, a B.E.A. Viscount ran into the control tower building at Luqa, Malta, apparently as a result of brake failure during landing. The captain and two passengers were injured, none seriously.

CARRYING THE P.M.—Mr. Harold Macmillan, the Prime Minister, flew in a specially equipped B.O.A.C. Britannia to Accra on January 6 at the start of his African tour. The same aircraft was to take Mr. Macmillan and his party on to Nigeria and Rhodesia, and back from Las Palmas in the Canary Islands at the end of his tour.

NATIONAL LOSS.—A DC-6B of National Air Lines flying from New York to Miami crashed into the Green Swamp area of North Carolina on January 6. All 34 occupants were killed. The flight was one of two substituted at short notice for a Boeing 707 which developed a mechanical fault at New York.

News About People

M.o.A. APPOINTMENT.—Mr. B. D. Fraser, C.B., has been appointed a Deputy Secretary in the Ministry of Aviation. He succeeds Mr. R. G. K. Way, C.B., C.B.E., who was recently appointed Permanent Under Secretary of State for War. Prior to his new appointment, Mr. Fraser was a Third Secretary in the Treasury.

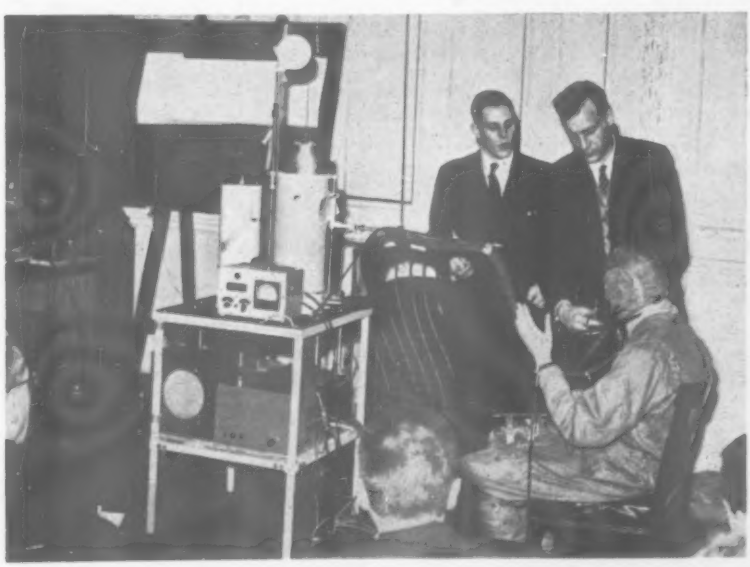
SWISSAIR MANAGER.—Mr. M. A. Keller has been appointed Swissair general manager for the U.K. and Ireland in succession to Mr. W. Wyler, who has become general manager for Western Switzerland and a member of the general management.

NEWS FROM DOUGLAS.—Kenneth G. Farrar has been appointed vice-president in charge of manufacturing, for the Douglas Aircraft Company. He has been general manager of the company's Long Beach Division since September, 1953, and a vice-president of the company since April, 1954. He succeeds Frederic W. Conant, who recently announced his retirement.

T.C.A. APPOINTMENT.—Mr. Gilbert G. Minorgan has been appointed T.C.A. stations operations manager at London Airport. He held a similar position at London when T.C.A. services started in September, 1946, and has subsequently been at Prestwick and in Bermuda.

B.O.A.C. IN THE U.S.A.—The B.O.A.C. sales organization in the U.S.A., has been divided into three regions under the sales manager, U.S.A., Mr. H. F. Good. Appointed regional sales managers are Mr. W. J. Reardon Shepherd (Eastern States), Mr. P. Graham Bell (Pacific States) and Mr. E. Burnikel (Central States). Mr. H. Laird Loftis is appointed sales manager, island services, in New York.

A.E.I. SALES.—Mr. G. E. V. Ling has been appointed assistant manager, Aircraft Equipment Sales, Coventry, of the A.E.I. Motor and Control Gear Division. During the past four years he has been in charge of the technical sales section.



Mr. A. S. Bishop

GOODYEAR RETIREMENT.—Mr. A. S. Bishop, chairman of The Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd., is retiring on January 31. He will remain on the company's board as a director.

AER LINGUS APPOINTMENTS.—Mr. Kevin Gibney has been appointed Aer Lingus technical superintendent at Shannon after 10 years as district operations superintendent at London Airport. He is succeeded by Mr. Brian Tutty, who has been his deputy since 1954.

ELECTRONICS APPOINTMENT.—Mr. W. P. Rowley, M.B.E., Brit.I.R.E., has been appointed assistant managing director of W.S. Electronics, Ltd., a wholly owned subsidiary of K.G. (Holdings), Ltd. He took up his duties on January 1.

CAPTAIN O. E. ARMSTRONG.—We regret to record the death of Captain O. E. (Paddy) Armstrong, a veteran airline pilot. He flew with Aer Lingus before the War and was chief pilot—and later manager—of Morton Air Services at Whitchurch Airport. He subsequently joined Cambrian Airways as a pilot.

EXPLAINING AERO-MEDICINE.—This year's young people's lecture organized by the Royal Aeronautical Society was given on January 7 by Dr. G. Melvill Jones of the Institute of Aviation Medicine. Here, Dr. Jones (left) prepares to demonstrate the effect of lack of oxygen.

Photograph copyright "The Aeroplane and Astronautics"

Air Transport

Decca Under Fire Again

ON January 5 the U.S. Federal Aviation Agency issued an adverse summary statement about its evaluation tests of Decca—using the low-power New York chain and Mk. 10 equipment in a Convair. This statement was issued in advance of a detailed report and referred rather pointedly to the decision at ICAO's special navaid meeting in Montreal in February, 1959, and to IATA support for VOR/DME. It is also, perhaps, significant that it was issued in advance of the ICAO meeting (probably in March) at which the Council of the Organization will consider the Montreal findings.

Nevertheless, the F.A.A. is an independent body of technicians and administrators and its job is to do the best it can for the future of U.S. and international aviation. Whilst the judgment of its personnel will necessarily be biased in favour of existing national aids, the Agency would not and could not be anything but scrupulously honest in an evaluation of this kind. Since the U.K. is backing Decca it must also be supposed that the Ministry specialists on this side of the Atlantic are technically convinced of the rightness of their decision.

Therefore, the only possible explanation for this divergence of basic opinion about the system lies in a fundamental difference in view about what a universally applicable navigation system should be designed to do. In simplest terms it might be said that the F.A.A. is looking at the deficiencies of the Decca area-coverage system from a point-source-system viewpoint, and that the M.o.A. is looking at VOR/DME deficiencies from an area-coverage philosophy viewpoint. Neither system will do all the work of the other, but the U.K. specialists believe that the area-coverage system has long-term advantages which the point-source system can never offer.

A look at the shortcomings of the Mk. 10 when being used as a primary IFR aid, as listed in the F.A.A. statement shows the differences in the yardsticks which are being used. The F.A.A. says that:

"1. The system was subject to deviations of the tracking pen on the flight log display which in turn presented incorrect navigational information to the pilot.

"2. Without a pre-printed course, the pilot lacked the position accuracy information required for holding and for homing between fixes.

"3. The system was subject to loss of zone identification at intermediate ranges, distances at which satisfactory coverage was expected.

"4. Problems were encountered in simulated instrument approaches. Simulated instrument approaches were made to Idlewild and La Guardia airports and to Logan International, Boston. At Idlewild and La Guardia approaches could be made that were comparable to those with the ADF but in the Boston area the positional information was not usable."

A system designed to provide a continuous running pictorial plot of position is being compared (1) with another which is designed to provide spot bearing and homing facilities and distance-measuring information. So long as special projections are required for the Log it will obviously be necessary (2) to provide pre-printed lines for holding patterns and for tracks-to-be-made-good. The summary of the report does not say how or where the zone identification losses (3) were suffered; continuous automatic lane identification is, however, available. The accuracy of Decca as an approach aid (4) depends on the pattern in the area being flown and its use for this purpose is no more than incidental; Boston is, in any case, on the fringe of the New York chain coverage.

Rail-Air Rationalization?

LAST week's news stories to the effect that the British Transport Commission may take a financial interest in British Aviation Services/Silver City Airways had at least two good results. The possible prospects for such collusion were vigorously explored in the articles concerned and the B.A.S. background was thoroughly explained. So the interested reader learnt about the composition of a major independent airline operator and about the ways in which surface and air transport might be rationalized for the benefit of the traveller.

There has, in fact, been some useful co-operation already between the British and French Railways and Silver City in the operation of this airline's rail-air service between London and Paris. There are good prospects, too, that the railways will help in the development of this and other services by the construction of spur lines into Manston and Le Touquet, so that the overall travelling time may be shortened by cutting out the intervening coach journeys. Many means may be envisaged by which rail and air could also be used to best advantage in providing faster, low-cost connections between centres in the areas once known as the British Isles.

Meanwhile, all that can be said is that discussions have been in progress between Silver City and the B.T.C. for more than a year on matters of mutual interest and that the Commission might take a financial interest in British Aviation Services. B.A.S. shareholdings are at present divided between the Peninsular and Oriental Steam Navigation Group (70%), Eagle Star Insurance (20%) and Cable and Wireless (Holding) (10%).

When Silver City's eventual re-equipment programme—involving bigger-capacity aircraft suitable both for vehicle-ferry and short-haul passenger operations—is decided upon it may be that more capital will be required and such capital might well come from new sources. British Railways are precluded from operating air services, but there is nothing to prevent the Commission from taking a financial interest in an existing airline operating company—so long, presumably, as this interest does not involve direct airline competition between nationalized rail and nationalized air transport undertakings.

Pooling the Timetable

THREE airlines—Pan American, T.W.A. and Air France—have agreed to schedule the same journey times on their transatlantic services with Boeing 707-320 Intercontinentals, with effect from January 10. This step is a logical, if revolutionary, one, and should remove the tendency for unrealistic flight times to be claimed in airline advertisements. Actual times agreed for the winter season are: London-New York, 7 hr. 40 min.; Paris-New York, 8 hr.; New York-London, 6 hr. 25 min.; and New York-Paris, 6 hr. 45 min.

Timetable times are, of course, based on each particular airline's normal operating techniques, applied to specific route conditions in various seasons. They depend, also, on the degree of terminal punctuality which the airline wishes to achieve: obviously, the longer the time allowed for the journey, the higher the percentage of on-time arrivals which will be achieved. Conversely, an airline may be prepared to accept a slightly worse record of terminal punctuality for the sake of a timetable advantage of 10 minutes or so. When several airlines are using precisely the same equipment over the same route, however, claims for the fastest service, based on paper advantages of five or 10 minutes, become rather ridiculous.

The T.W.A.-Pan Am.-Air France agreement may well set a pattern to be followed on other routes where competitors use the same equipment. This will be the situation on the London-New York route after April, when B.O.A.C. too will be offering 707 services.

Commenting on the arrangement, a B.O.A.C. spokesman said that the Corporation would fall in line with the other operators unless its Conway-engined 707s proved substantially faster than the versions at present operating over the Atlantic. This will not be known until some experience has been obtained on proving flights. The Conway 508s in the B.O.A.C. aircraft are rated at 17,500 lb.s.t. for take-off compared with the 15,800 lb.s.t. rating of the JT4A-3 in the 707-320—but it would not necessarily be commercially advantageous to take out this extra power in higher operating speeds.

With the same type of aircraft and the same journey time to offer to the public, the airlines advertising managers will have a pretty problem in future if they are successfully to advertise their own particular service rather than air travel in general. The most significant competitive factors left will be in choice of times of departure and arrival and standards of cabin service.

B.E.A. Helicopter Plans

MORE became known last week of British European Airways' plans to revive scheduled helicopter services in this country and to inaugurate international services. We have previously recorded (in our issues of September 11 and October 23, 1959) the Corporation's intention, subject to financial help from the Government, to start such services by 1961.

Formal application has now been made by B.E.A. to the A.T.A.C. for approval, for 10 years, for helicopter services from London to Birmingham and/or Manchester; London to Paris; London to Brussels; London to Amsterdam; and Land's End to the Scilly Isles. The application states that the services will be operated initially with Sikorsky S-61 and Vertol helicopters, and later also with the Rotodyne. It is unlikely that both types of American helicopter will be purchased, and we understand that the initial order, after a final evaluation of the

(*Continued on page 63*)

Only the VANGUARD

paces the jets at much less than half the cost

ALL ROUND Europe, and on record flights in Canada, the Vickers Vanguard has been logging block times which have proved that on short and middle distance routes it can more than hold its own with the jets. It has, in zero wind, beaten current jet schedules on sectors as long as London-Rome (955 st. miles). It has flown London-Gander (2,365 st. miles) in 5 hours 30 minutes, and Toronto-Montreal (335 st. miles) in a record 58 minutes in zero wind.

Other Vanguard block times are:

LONDON-BRUSSELS
230 miles in 45 minutes (5 m.p.h. headwind).

LONDON-HAMBURG
470 miles in 73 minutes—a record (17 m.p.h. tailwind).

LONDON-PARIS
224 miles in 41 minutes (zero wind).

PRESTWICK-KEFLAVIK
920 miles in 2 hours 35 minutes (zero wind).

KEFLAVIK-MONTREAL
2,360 miles in 6 hours 2 minutes (30 m.p.h. headwind).

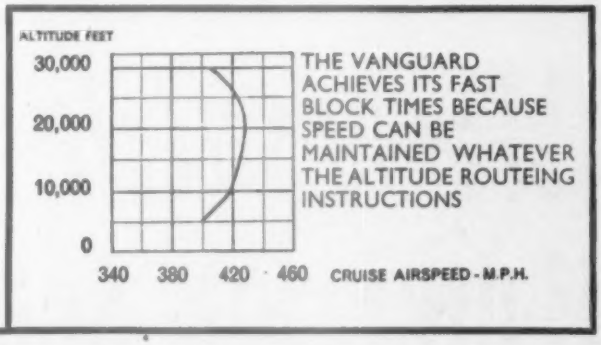
The Vanguard has achieved these block speeds at costs nearly one-third of those of comparable pure jet aircraft.

Recent U.S.A. figures show jet aircraft flight hour direct costs as 2.8 times greater than those of the Vanguard, and seat mile direct costs 2.6 times as great.

The Vickers Vanguard has, without doubt, the biggest profit potential ever offered to the airline industry — and it offers it at proved realistic competitive speeds.

The Economy Class cheap-fare capabilities of the Vanguard are at the forefront of the now established world movement for popular air travel. Only the Vickers Vanguard can bring these vast new markets to the Airlines on short and medium haul routes, at a substantial profit, and the Vanguard can do this with schedules as fast, if not faster, than any other aircraft.

Vanguard costs used in this comparison are to A.T.A. formula. Both the Viscount 745 and the Viscount 810 filed costs have been proved in practice to be substantially below such A.T.A. formula costs.



Of all the airliners only the Vanguard has all these features

425 m.p.h. cruising • Freight capacity 7/8 tons at normal densities • Full routeing and A.T.C. flexibility • Can use normal existing airfields • Quick turn-round • No airfield noise problems • Ten years' unique Vickers/Rolls-Royce turbo-prop experience . . . ***And it is 'Viscount' quiet.***

VICKERS VANGUARD

FOUR ROLLS-ROYCE TYNE TURBO-PROP ENGINES

• ***The airliner with the biggest profit potential ever offered to the operator***

VICKERS-ARMSTRONGS (AIRCRAFT) LIMITED WEYBRIDGE SURREY

AT 627

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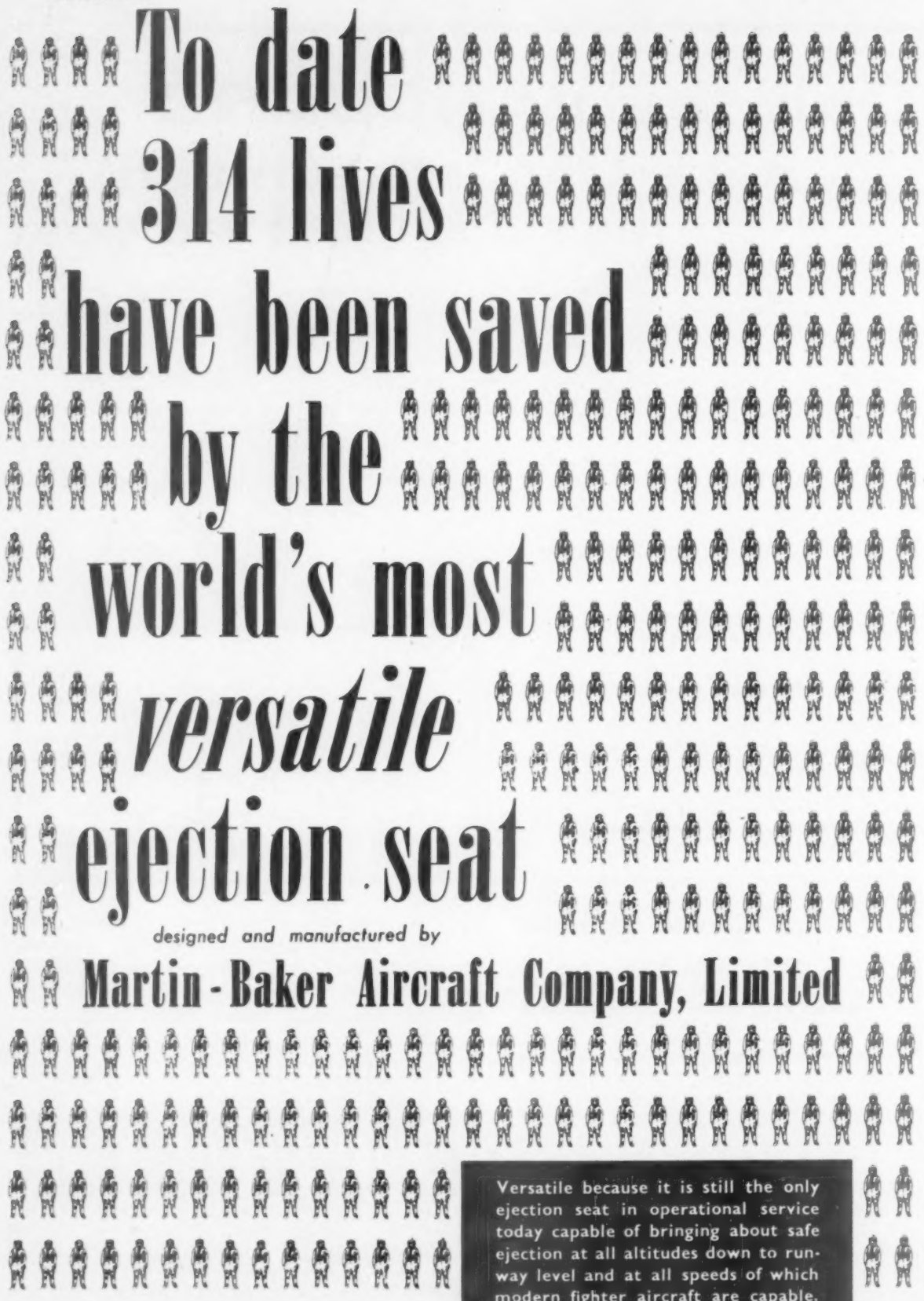

To date 314 lives have been saved by the world's most *versatile* ejection seat

designed and manufactured by

Martin-Baker Aircraft Company, Limited

Versatile because it is still the only ejection seat in operational service today capable of bringing about safe ejection at all altitudes down to runway level and at all speeds of which modern fighter aircraft are capable.

BOEING'S BABY.—A view of the first Boeing 720 on flight test, showing the leading edge extension on the inner wing which is a feature of this model. Lufthansa has now confirmed that it is about to order "three to five" Boeing 720Bs, with JT3D turbofan engines, for its South Atlantic and Far East services. Deliveries will begin in the spring of 1961.

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two types, will be for two machines. Both types are powered by de Havilland Gnome turbines and carry about 25 passengers. The whole operation is still subject to financial backing from the Government; this has not yet been obtained.

The first service to be operated would be that between Land's End and the Scilly Isles, where B.E.A. at present uses seven-seat Dragon Rapides at a frequency of up to 20 services a day during the summer. This service might begin by the middle of 1961. Services across the Channel are not likely before 1962, and the Birmingham/Manchester service may not be started until the Rotodyne comes along.

B.E.A. is also studying the idea of a co-operative agreement with other European operators covering helicopter services. Such an agreement, if concluded, might lead to a pooled operation over, for instance, the London-Paris-Brussels-London triangle.

Applications to operate regular helicopter services from a central London heliport have already been made by Inter-City Airways, Ltd., a prospective operator associated with Rotorports, Ltd. Fison-Airwork, Ltd., has also now asked the A.T.A.C. for approval for helicopter services over the routes London Heliport (Battersea) and/or London Airport and/or Gatwick and/or Lydd and/or Southend; and London Heliport-Birmingham. This application specifies Whirlwinds initially, and later the S-58, S-61, S-62, Rotodyne and Vertol 107.

The Air-freight Business

THE proposal that financial aid should be made available for the encouragement of all-freight operators and aircraft manufacturers seems to have been revived in the U.S.A. Last year the idea of reducing the work done by the Military Air Transport Service and providing loans for the purchase of all-freight equipment by civil operators was suggested, but the proposals were resisted in some quarters.

Now it appears that the chairman of the Senate Aviation Sub-committee, Senator Mike Monroney, is to introduce his long-delayed bill to encourage the expansion of the U.S. commercial air cargo fleet and to build up a reserve "big enough to fly several divisions of troops." The bill would authorize the C.A.B. to guarantee repayment of 10-year loans for the purchase of approved all-cargo or converted aircraft—with limitations on the total amount ($75 million) to be borrowed by any one carrier and with the stipulation that each carrier must itself provide 25% of the purchase price. The Government would guarantee repayment of 90% of any unpaid balance and be able to impound the aircraft on default.

Well, there might be something to be said for such a scheme if transport aircraft reserves are needed for military purposes—but most people have learnt to be suspicious of artificial respiration of this kind. If the business is known to be there then private capital should automatically be available. When capital is not available then there is something doubtful about the business—or there are, as in Europe, legal difficulties about the security of the security (in this case aeroplanes) available to the persons providing the capital.

Not much prominence has been given to the fact that Canadair has developed an integrated cargo-handling system for the CL-44 to ensure a minimum-time turn-round. It covers all phases of cargo handling and includes preloaded pallets and bins, mechanized loading, built-in handling equipment and appropriate terminal facilities.

A nine-ton, 24-ft.-plus section of a ship's propeller shaft was flown out from L.A.P. to Calcutta last week in a K.L.M. L-1049. According to *Lloyd's List* the loading of the shaft was originally thought by another carrier to be an "impossible" exercise, but, with the help of a mobile crane, it was in fact completed in slightly more than an hour. K.L.M. loaders flew with the aircraft to Calcutta to supervise the unloading. The cost of the charter was high—but then so was the cost of keeping an Ellerman Lines cargo steamer out of service.

Back to Madeira

APPLICATIONS to operate scheduled services from London to the Madeira islands have been made to the A.T.A.C. by British European Airways, Airwork and Hunting-Clan. Both the Corporation and the two independent operators base their plans on the forthcoming completion—towards the end of this

ROTARY RED.—The twin-engined Yak-24 is reported to be in use with Aeroflot on scheduled passenger services, for up to 40 passengers on short-hauls. This Yak-24K appears to be a new version, with 'panoramic' windows. In common with other Soviet helicopters, it has auto-stabilization equipment.

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year—of Madeira's first airport, on the island of Porto Santo.

Work is now going on to complete a 6,500-ft. concrete runway, taxiways, aprons and terminal buildings at Porto Santo, which is some 10 miles north-east of Madeira. Further extension of the runway to a maximum of 11,500 ft. has been projected. Later this year, also, work is to begin on a smaller airport at Santa Catarina, to serve Funchal, on the island of Madeira itself. This will have a 5,250-ft. concrete and asphalt runway, which will be adequate for a feeder link with Porto Santo if not for direct services from the U.K. and elsewhere.

The B.E.A. application specifies Viscounts and Comets initially and Vanguards and D.H.121s later, at a frequency as required by traffic demand and with an optional stop at Lisbon. Airwork and Hunting-Clan ask for permission to operate four Viscount services a week via Lisbon (but without London-Lisbon traffic rights) and also wish to make Porto Santo an optional traffic stop on their tourist Safari service to Ghana.

Madeira has been deprived of air services since the Aquila flying-boat operations were suspended in September, 1958. The Portuguese Artop company unsuccessfully attempted to establish a similar service, using Mariners, at the end of 1958.

Measuring Landing Minima

UNDER a Federal Aviation Agency research programme, methods of defining and measuring airport ceiling and visibility are being studied at the National Aviation Facilities Experimental Center, Atlantic City. The two significant landing minima have been defined by the F.A.A. as the A.L.C.H. (approach light contact height) and the R.V.R. (runway visual range). The A.L.C.H. is the altitude at which a pilot descending on final approach along the glide path can first expect to see the high intensity approach lights leading to the runway, and R.V.R. is the forward visibility along the runway from the point of touchdown.

To determine the A.L.C.H. value, readings from a transmissometer, a rotating beam ceilometer and an illuminometer (light meter) are required, as well as information on the intensity setting of the approach lights. At present, computation of the value is by manual processes, but a U.S. Weather Bureau electronic computer is to be used later this year. The values are passed to the pilot as he crosses the outer marker.

Measurements for the R.V.R. are based on the readings of a transmissometer adjacent to the touchdown point on the instrument runway. Allowance is also made for the intensity setting of runway lights and for day or night illumination conditions. At Newark, Washington, Idlewild, La Guardia, Boston, Los Angeles and Fort Worth, controllers at present receive the R.V.R. information on direct-reading meters, but computers are to be installed to correct these readings into linear measurements. The R.V.R. value is reported to the nearest hundred feet.

Braking Action Measurement

THE Ministry of Aviation is to introduce a standard method of measuring the braking action of runways affected by snow or ice at 23 British airports under its jurisdiction. A brake-testing meter, mounted in a light van, will measure the coefficient of friction, which will be indicated as "good" (0.35 or more), medium (between 0.25 and 0.35) and poor (below 0.25). The van will travel at 30 m.p.h. to make the measurement.

Braking values will be reported to aircraft commanders by R/T and will be included in Class One Notams. The airports at which the measurements will be made, each winter, are:—

Aberdeen (Dyce), Belfast (Nutt's Corner), Birmingham (Elmdon), Blackbushe, Bournemouth (Hurn), Benbecula, Cardiff (Rhoose), Edinburgh (Turnhouse), Gatwick, Inverness (Dalcross), Islay (Port Ellen), Kirkwall Liverpool (Speke), London, Machrihanish, Manchester, Prestwick, Renfrew, Stansted, Stornoway, Sumburgh, Tiree, Wick.

Full Circle

ONCE upon a time, when aeroplanes were beginning to be aerodynamically cleaner, when field-lengths were still short and when landings had to be done properly on three points, the final approach and touch-down were the really difficult things for a pilot to handle with neatness and consistency. Then, with bigger fields and hard surfaces, and with the arrival of flaps and tricycle undercarriages, the whole thing became something of a gift for the reasonably competent and practised pilot. Real accuracy in the judgment of speed and approach gradient was necessary only when a runway was very short.

Now we seem to have travelled full circle and, with the turbojet transports, are back where we started, with the final approach and landing as the most critical phases of a flight so far as human skill and judgment are concerned. Certainly the majority of the incidents reported in connection with turbojet operations—mainly during training and check flights—have occurred during the flare-out and landing phases. These have included at least two undershoots, with consequent structural damage, heavy landings and pod scrapings.

Boeing and other representatives and pilots have explained many times that more careful judgment is required, particularly in the matter of speed control, when handling the 707, and there are a number of related reasons for this fact—which applies, in greater or lesser measure, to all turbojet aircraft.

But the primary reason for the trend in the pattern of incidents is likely to be that pilots are all too conscious of the relative shortness of available runways and are anxious not to arrive at the threshold with excess speed. Given more adequate runway and stopway distances all approaches could be made with bigger speed margins—and lighter hearts. Although, for instance, the B.C.A.R. factor of 1.82 (for turbojets without reverse thrust) on the demonstrated gross landing distance from a screen height of 50 ft. may seem to provide a fairly adequate margin for all adverse circumstances, the fact remains that, with a clean turbojet transport, 10% excess speed probably results in a landing-distance increase of more than 20%.

The difficulties will be reduced by the introduction of visual glide-path indicators at all major airports—but the records show that about 80% of undershoots occur in comparatively good weather. So the question remains: has the pilot a sufficient margin for minor error?

In a recent news bulletin IFALPA offered a summary of the approach-judgment factors connected primarily with the introduction of the turbojet:—

"1. The deceleration from the speed at the outer marker to the speed at the threshold has become greater. For example, with the Convair 880 it is necessary to shed (at max. landing weight) 32 kts. during this segment. This calls for a deceleration about 14 kts. per min. Corresponding figures for the DC-3 would be 15 kts. to be shed at 5 kts. per min. It is plain that the faster change of speed makes it more difficult for the pilot to arrive at the threshold at the correct figure. . . .

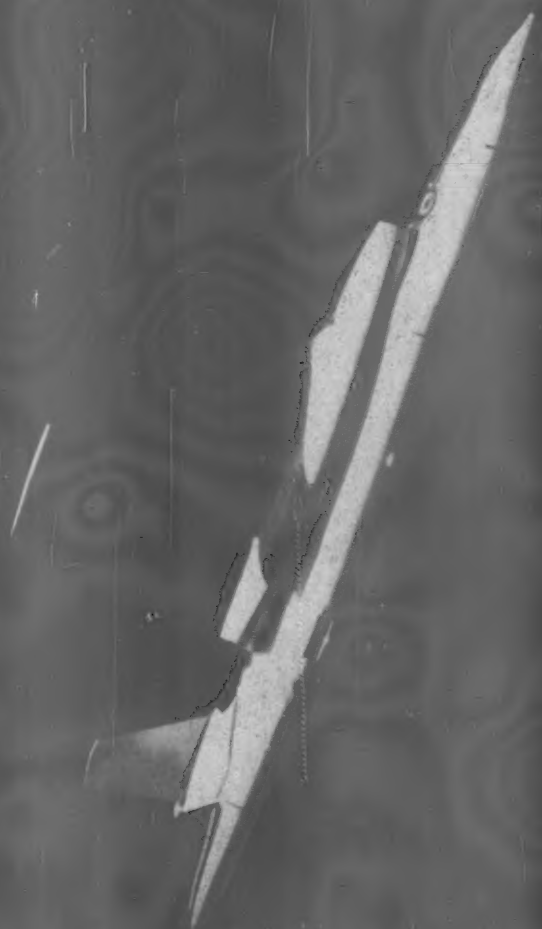
"2. The increased centripetal effect during the flare-out of a heavier aircraft will be adverse. This will come into play at the initiation of the flare-out where, it so happens, most of the undershoot incidents seem to occur. The effect of elevator movement to check descent is temporarily but significantly to increase the wing loading and, consequently, the stalling speed . . . becomes appreciably higher. The amount will vary aircraft to aircraft and will depend on the degree and speed of elevator movement. It will generally have an effect equivalent to 5-10 kts. loss of speed margin above the stall. If this margin is low (and it is never very high at this point), this loss of speed margin may result in a (perhaps temporary) loss of control and . . . in a premature touch-down or a heavy landing.

"3. The third factor is the clean design and consequent long float of jet aircraft. A pilot once experiencing the distance penalty (10% excess speed=approx. 21% excess distance) associated with carrying a little too much speed at the threshold may tend in subsequent landings to dissipate the excess well ahead of the threshold. This is a difficult judgment to make, especially in conditions of high wind or turbulence, and will sometimes result in shedding speed a little too much or too soon or both. So here again is a tendency towards the premature touchdown.

"4. It should be noted that factors 1, 2 and 3 are related and may be additive. But, as if this were not enough, a fourth influence may also be unfavourable. This is the slow build-up of the safety margin (i.e., margin above stall) on the application of power. In a piston-engined aircraft, if it is discovered that the approach is a little low or slow, recovery can be effected almost immediately, since increase in engine speed almost instantaneously results in increased slipstream and decreased stalling speed (by about 10 kts.). Now, while the jet engine may accelerate from idling to full power in the same time as a piston engine, it contributes to the margin above stall only when the speed of the aeroplane has had time to build up. This is longer than the time for build-up of propeller slipstream. So again the factor is adverse."

These, the writer suggests, are the main contributors to the undershoot problem, which should be and is being tackled through ICAO by IFALPA. "A quicker way," he adds, "has, however, been applied in Greece where, for President Eisenhower's landing at Athens on December 14, 1959, eight houses were demolished at 48 hours' notice in order to provide the required landing length."

The NA.39
has been ordered
for the Royal Navy



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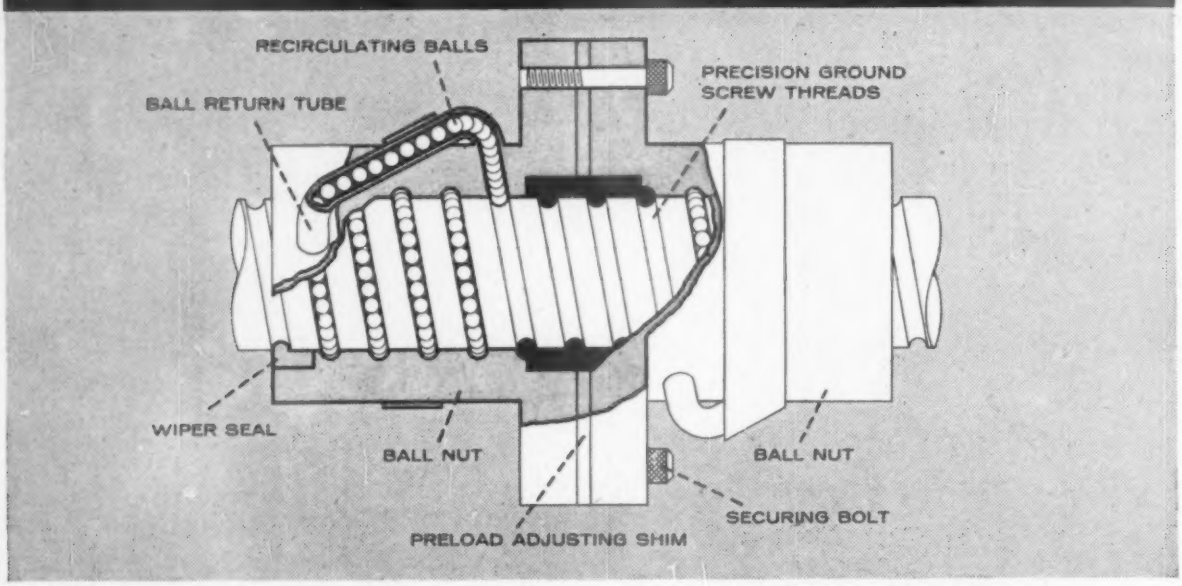
Beaver pre-loaded ball screws, up to 95% efficient, operate at -52°C to over 400°C with no backlash...



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Machined and ground to the highest standards of precision engineering Beaver pre-loaded ball screws greatly increase transmission efficiency. They reduce the power required for actuation by as much as 80%, when converting rotary drive into linear output or force input into torque output. By eliminating backlash, with pre-loading, they give precise control over very small increments of motion and a high response frequency. And when compared to conventional screw mechanisms, they provide a predictable operating life which is much longer, require much less maintenance and give more trouble-free operation.

Basic design application analysis

Bristol Siddeley engineers make an exhaustive analysis of each specification. And each unit is specially designed for its particular application. Beaver ball screws are made automatically reversible or with controlled "no-back," with multiple or single circuits. Beaver pre-loaded ball screws have been proved as the most efficient method of converting rotary into linear thrust in over 2,700 engineering applications in many branches of industry. They have been designed already with rated operating load capacities of 370,000 lb (825,000 lb maximum static load) but the maximum potential operating load is, in most cases, limited only by the requirement.

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BRISTOL SIDDELEY ENGINES LIMITED

Air Transport . . . .

Hermes in the Bahamas

TWO of the eight Hermes 4s owned by Skyways, Ltd., have now been transferred to Bahamas Airways, Ltd., in which Mr. Eric Rylands and Mr. David Brown jointly own an 80% interest. These Hermes have been used since mid-December on the routes from Nassau to Miami and Palm Beach.

Before going to the Bahamas, the two Hermes underwent an extensive "face-lift" and have reappeared as 78-seaters. In B.O.A.C. service they seated 56 and, with Skyways, 68. Seat pitch varies between 36 and 39 inches and additional windows have been added to match the extension of the cabin area. Décor is in keeping with "the colourful local atmosphere" and capacious fittings have been provided for hand-luggage and clothes.

Pressurization is not required on the routes flown by these Hermes and part of the system has been removed. A new emergency escape exit has been introduced in the starboard rear cabin. In the area of the main entrance door, a small galley provides facilities for all the catering required, and a compact cocktail bar has been installed.

On the flight deck, the navigator and radio officer stations have been eliminated, leaving provision for two pilots and a flight engineer. Radio equipment, all pilot-operated, is on the starboard side, replacing the navigator, and a new baggage hold is located to port in place of the radio station.

Skyways was responsible for the design of the modifications and for the work involved. Despite the increase in capacity by 10 seats, the empty weight has been reduced from 52,850 lb. to 52,603 lb.

Catering for all Classes

IN the coming summer, B.E.A. will be offering five times as many first-class seats as last year. This follows the trend over the past two years of offering mixed-class services on many routes; previously, B.E.A. had restricted itself to a few selected "Silver Wing" services, which were exclusively first class.

The first mixed-class aircraft used by B.E.A. were the Viscount 806s, and this configuration is being continued in the Comet 4B (22 first-class seats) and the Vanguard (23 first-class seats). The introduction of Comets and Vanguards on B.E.A. routes in the coming summer is largely responsible for the big increase in first-class capacity to be offered.

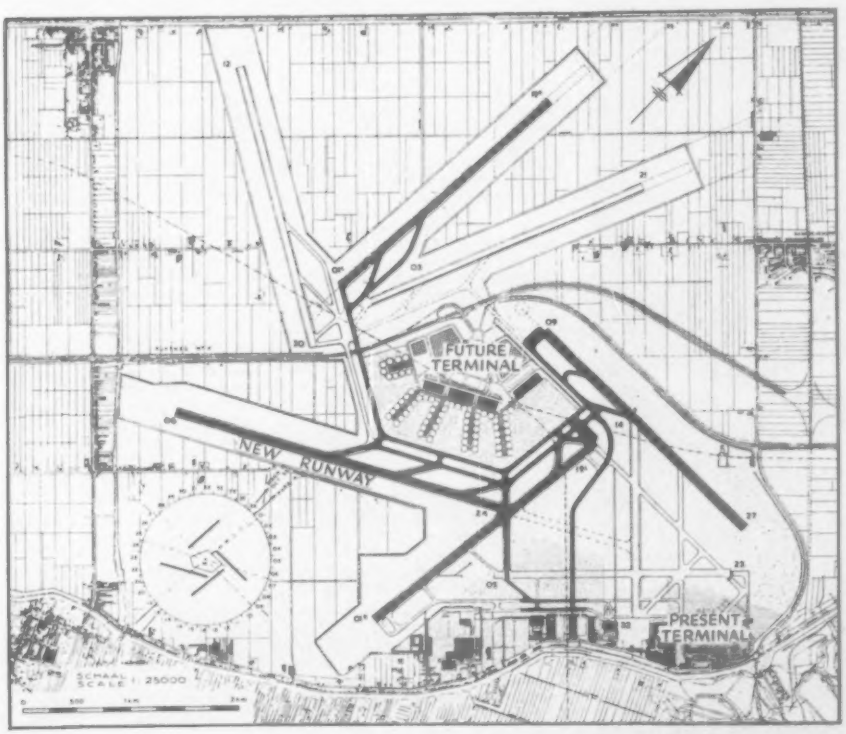
At Dorland House, Lower Regent Street, for the past two weeks B.E.A. has been showing the public something of the activities of its Catering Branch, which looks after the gastronomic requirements of more than 3 million passengers a year. The exhibition, which ends tomorrow (January 16) includes examples of the meals which travellers can expect in first, tourist or economy class and each day a first-class lunch is served from an aircraft galley to guests in a 24-seat "aircraft cabin."

Tomorrow's Schiphol

WHEN the new 10,827-ft. runway 06/24 at Amsterdam's airport is opened for use in April it will be the second to be laid down in conformity with a long-term plan. This plan—involving, like the original one for London Airport, a runway system which is tangential to a central terminal area—was first formulated more than 10 years ago, but was not officially approved until 1957 and the layout proposed at that time was described and illustrated in THE AEROPLANE of June 21, 1957 (p. 871).

In fact, as the plan on this page shows, very few major changes have been made since that date, and the detail layout of the central terminal building has still to be finalized. The minor changes in the runway and taxi-track system are, nevertheless, important and show the development of thinking in such matters as high-speed turn-offs and the fully rational use of a tangential system. The turn-offs and taxi-track arrangements for the new runway are designed for landing in one direction (towards the central terminal area) and for take-off in the other (away from the terminal area) and this system will apply to the four (or possibly six) runways in the final pattern, so that taxi-ing distances will be reduced to a minimum.

There are, at present, four runways in use at Schiphol. Of these, only the main 8,367-ft. instrument runway (01/19) will be part of the final pattern, which has had to be planned very carefully in relation to expansions of the city of Amsterdam—which, with the Dutch government and the city of Rotterdam, is one of the shareholders in N.V. Luchthaven Schiphol, which was formed in 1957. Previously Schiphol was the responsibility of the city of Amsterdam.



The broad plan for the new terminal, north-west of the present airport area, was to be agreed before the end of 1959, but completion of the building is not visualized before 1964-65. Meanwhile, however, traffic continues to increase and intermediate plans have been made to deal with the interim period during which passenger movements may be expected to rise from the present million per annum to a figure of about 1,400,000.

Temporary extensions of the present passenger terminal are being put in hand in two stages—one for completion in time for the busier months this year and another for completion in readiness for the summer of 1961. Present plans for the new central terminal include the use of four main piers or "fingers" and one subsidiary pier from the main building, and the reorientation of a short section of the Amsterdam-The Hague highway around the new terminal area and under the taxiway which will lead to the tangential runway which is due to be laid down to the north-west of the present airport area.

G

The Fighting Services

F.A.A. Promotions

INCLUDED in the half-yearly list of provisional Royal Navy promotions to date from June 30, 1960, are the following Fleet Air Arm officers and officers serving in aircraft carriers or Air establishments.

Commander W. P. B. Barber, D.S.C., executive officer, R.N.A.S. Arbroath; Cdr. J. E. Pope, executive officer, "Centaur"; Cdr. M. W. Peters, air engineering officer, "Victorious," are to be promoted to the rank of captain.

Lieutenant-Commander I. R. Bowden, navigating officer, "Victorious"; Lieut.-Cdr. W. J. Cooper, observer's appointments, Admiralty; Lieut.-Cdr. P. J. M. Shevlin, gunnery officer, "Victorious"; Lieut.-Cdr. I. J. Brown, Lieut.-Cdr. (Flying), R.N.A.S. Lossiemouth; Lieut.-Cdr. J. B. Robathan, Flag Lieut. and personal pilot to F.O.F.T.; Lieut.-Cdr. R. W. T. Abraham, air warfare division, Admiralty; Lieut.-Cdr. G. R. Higgs, C.O., No. 803 Squadron; Lieut.-Cdr. R. Greenshields, chief tactical instructor, Helicopter Station Portland; Lieut.-Cdr. H. G. Julian, D.S.C., formerly of "Albion"; Lieut.-Cdr. T. G. F. Hardy, air engineering officer, No. 892 Squadron; Lieut.-Cdr. H. K. Dean, deputy supply officer, "Hermes," are to be promoted to the rank of commander.

Instructor Lieutenant-Commander J. A. Moore, of R.N.A.S. Arbroath; Instr. Lieut.-Cdr. T. O. K. Spraggs, of R.N.A.S. Hal Far, Malta, are to be promoted to the rank of instructor commander.

Technical Awards

HIGHER National Diplomas in mechanical and electrical engineering have been awarded to more R.A.F. candidates in 1959 than in any year since the Technical Cadet scheme was inaugurated in 1955. Of 28 cadets sitting the examinations at the R.A.F. Technical College, Henlow, 27 passed with six gaining distinctions.

From the parallel university courses at Oxford, Cambridge and London, 10 R.A.F. cadets graduated with degrees under the same scheme. A B.A. and B.Sc. with first-class honours in mechanical science and aeronautical engineering went to two cadets, four more secured B.A.s with second-class honours in mechanical science, and the remaining four cadets received B.A.s with third-class honours in mechanical science and engineering science.

Director of Plans

AIR COMMODORE R. J. P. PRICHARD, C.B.E., D.F.C., A.F.C., has been appointed Director of Plans at the Air Ministry. Serving on the directing staff of the R.A.F. Staff College, Bracknell, from May, 1953, to the end of 1954, Air Cdre. Prichard commanded R.A.F. Tengah, Singapore, between 1956 and 1958. Promoted to the rank of Air Cdre. in July of last year, he has recently completed the Imperial Defence College course.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. A. C. Deere, D.S.O., O.B.E., D.F.C., to the Department of the Air Member for Personnel; Gp. Capt. S. G. Walker, O.B.E., to the Department of the Air Member for Supply and Organization; Wg. Cdr. E. Donovan, O.B.E., D.F.C., and Wg. Cdr. T. G. Young, O.B.E., to the Department of the Chief of the Air Staff.

Bomber Command: Gp. Capt. A. G. Wilson, O.B.E., D.F.C., to Headquarters as Gp. Capt. in charge of Organization; Gp. Capt. C. N. S. Pringle to Headquarters, No. 3 Group, as S.T.S.O.; Wg. Cdr. H. A. J. Steedman to R.A.F. Wyton as S.T.O.

Fighter Command: Wg. Cdr. O. L. Hardy, D.F.C., A.F.C., to R.A.F. Watton as Wg. Cdr. in charge of operations; Wg. Cdr. D. C. H. Simmons, A.F.C., B.A., to R.A.F. Coltishall to command the Air Fighting Development Squadron; Wg. Cdr. W. D. Hunter, to Headquarters for technical co-ordination duties. Sqn. Ldr. T. W. A. Hutton, D.F.C., to R.A.F. Coltishall to command the Administrative Wing; Sqn. Ldr. E. J. D. Masters to R.A.F. Watton for technical duties, and Sqn. Ldr. J. H. Walton, A.F.C., to R.A.F. Waterbeach to command No. 25 Squadron, all with the acting rank of Wg. Cdr.

Coastal Command: Wg. Cdr. B. Lewin, D.F.C., to R.A.F. North Front, Gibraltar, to command No. 224 Squadron; Wg. Cdr. P. H. Stembridge, D.F.C., A.F.C., to R.A.F. Kinloss as Chief Instructor, Maritime Operational Training Unit; Sqn. Ldr. G. H. Burgess to R.A.F. Kinloss to command the Flying Wing, and Sqn. Ldr. R. Currie, A.F.C., to Headquarters as Command Navigation Officer, both with the acting rank of Wg. Cdr.

Transport Command: Wg. Cdr. F. O. Barrett, D.F.C., to R.A.F. Benson to command the Flying Wing; Wg. Cdr. S. J. Rawlins, D.F.C., to R.A.F. Abingdon to command the Flying Wing; Wg. Cdr. E. W. Talbot, D.F.C., to Headquarters, No. 38 Group, for transport support duties. Sqn. Ldr. G. K. Bushell to Headquarters, for transport support duties, and Sqn. Ldr. W. I. Harris, A.F.C., to Headquarters, No. 38 Group, as Wg. Cdr. in charge of Operations, both with the acting rank of Wg. Cdr.

Flying Training Command: Gp. Capt. R. A. L. Morant, O.B.E., and Wg. Cdr. A. A. Smailes, A.F.C., to the R.A.F. Staff College, for directing staff duties; Wg. Cdr. D. W. Triptree, A.F.C., to R.A.F. White Waltham as Unit Commander; Wg. Cdr. F. S. Wright to the R.A.F. Selection Board, Cranwell, as Deputy President; Sqn. Ldr. J. Langston, to the R.A.F. Staff College, Bracknell, for directing staff duties, with acting rank of Wg. Cdr.

Maintenance Command: Wg. Cdr. W. M. Smedley to the R.A.F. Staff College, Andover, for directing staff duties; Wg. Cdr. E. J. Watts, M.B.E., to Headquarters No. 40 Group, for engineering staff duties; Sqn. Ldr. W. E. Hedley to the R.A.F. Staff College, Andover, for directing staff duties, with acting rank of Wg. Cdr.

R.A.F. Germany: Wg. Cdr. W. E. Colahan, D.F.C., to R.A.F. Laarbruch to command the Flying Wing; Sqn. Ldr. N. F. Curtis, to R.A.F. Goch for planning duties, with acting rank of Wg. Cdr.

More Service News

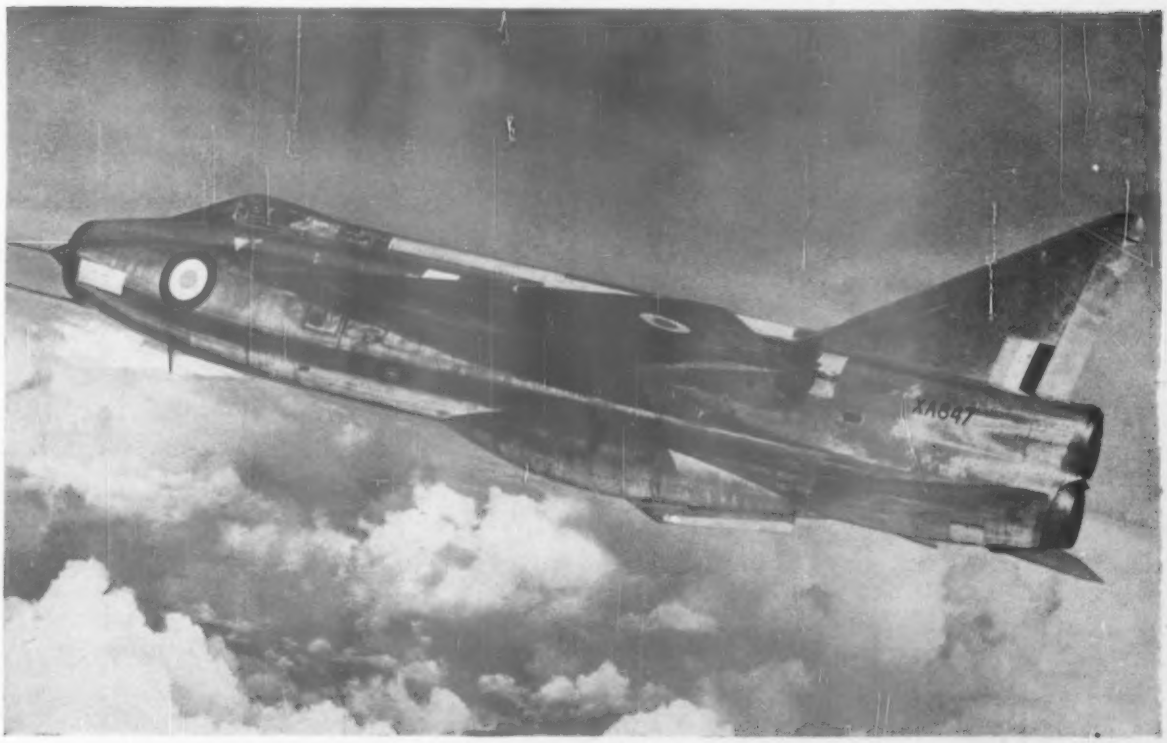
OCEAN RACING.—With a yacht now under construction in the Isle of Wight, the R.A.F. Sailing Association, after an absence of several years, will again be taking part in off-shore racing against the Royal Navy, Army and major yacht clubs during the coming season. The yacht, "Jethou," provided by the Nuffield Trust, is a masthead sloop of conventional appearance and will be skippered by Wg. Cdr. A. Hollingsworth for at least the first part of the 1960 sailing season.

ROCK AND W.R.A.F.—For the first time in the history of the Service, members of the W.R.A.F. are serving at Gibraltar. At the end of this month the Director of the W.R.A.F., Air Cdt. Dame Henrietta Barnett, will make a five-day visit to meet officers and airwomen of the first W.R.A.F. contingent on the Rock.

COTTESMORE BASED.—The first two Bomber Command squadrons to be equipped with Handley Page Victor B.1s—Nos. 10 and 15—are based at R.A.F. Cottesmore. This Vic is from No. 15 Squadron commanded by Wg. Cdr. D. A. Green, D.S.O., O.B.E., D.F.C.

AS A PIECE OF APPLIED AERODYNAMICS...

Over the whole of its phenomenal speed range—far more than 10 to 1—from its moderate landing speed, through subsonic and transonic speeds, up to its very considerably supersonic maximum, the ENGLISH ELECTRIC Lightning is inherently aerodynamically stable. Without any assistance from electronics it is at all speeds free from pitch-up.



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THE RIGHT SIZE AT THE RIGHT TIME. The present payload capacity of the "Forty Four" is ideally matched to the forecasted cargo requirements of the 1960's. It is in the '60's that the development rate of air freight will climb sharply toward the major breakthrough in air cargo traffic. The Canadair Forty Four is the right size for highly profitable operations during this rising development period.

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Canadair Forty Four, photographed in flight November 15, 1959

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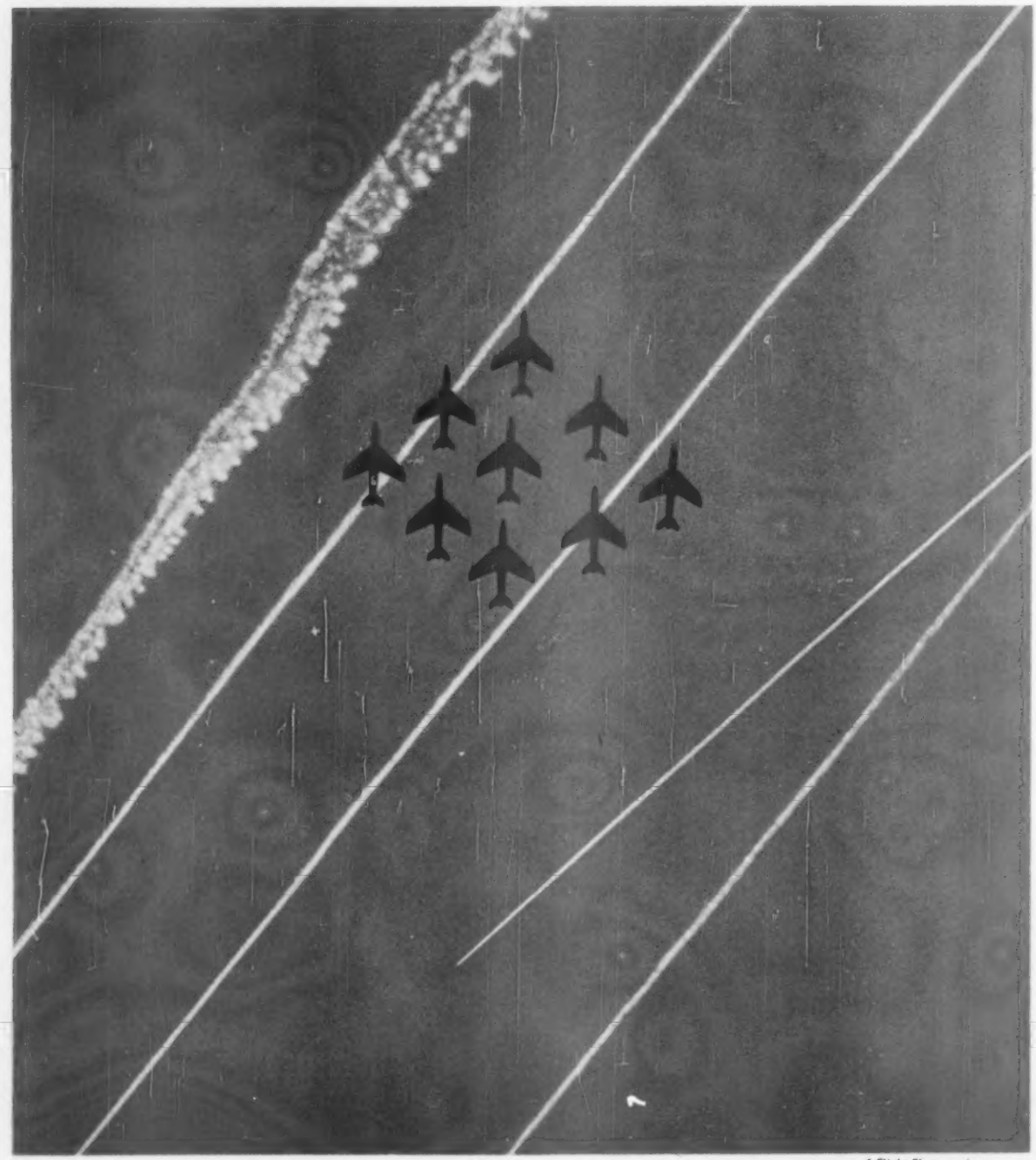


A Flight Photograph

Astronautics and Missiles

Achievements in Space Research

Comparing the results obtained by Russia and the United States over the past 15 years

EVER since 1957 when Russia launched the first artificial satellite, Sputnik I, and America failed in her first attempt with Vanguard, the Popular Press has referred to a "space-race" between these two World Powers. And invariably the yardstick with which the contest is measured is that of the most spectacular projects of the time, currently lunar and interplanetary probes.

In reality, there is no "race," and the region of really solid accomplishment in the space sciences is seldom mentioned outside the scientific and technical journals. Moreover, upper air and space research had been in progress much earlier than 1957 and since the end of the War both Russia and America have been steadily accumulating a vast fund of experience with sounding rockets as well as the more recent artificial satellites and space-probes.

What these achievements are has recently been listed† by Dr. Homer E. Newell, Jr., Assistant Director (Space Sciences) of the National Aeronautics and Space Administration, who has produced in tabular form a direct comparison of American and Russian work.

U.S.A.	U.S.S.R.
Magnetic Field	
1. Data on Earth's magnetic field were obtained from Pioneer I and Explorer VI, and a great deal of additional high-quality data were obtained from Vanguard III.	1. Data on Earth's magnetic field obtained from Sputnik III.
2. By their magnetic effect, electric current flows were plotted in the E and lower F regions, in rocket sounding experiments in the equatorial regions.	2. *No counterpart.*
3. *No counterpart.*	3. On Mechta, measurements were made of the Earth's magnetic field and its extension into space. A marked dip in the field was discovered in the region of the radiation belt, indicating perhaps the existence of a current ring such as postulated by Chapman.
4. Rocket measurements of the Earth's magnetic field have been made in the auroral regions.	4. N.C.
5. N.C.	5. Lunik II, on its plunge to the surface of the Moon, showed that the lunar magnetic field is not greater than 50 gamma.
Cosmic Rays	
1. Extensive data on cosmic ray intensities, composition, and interactions with matter were obtained from sounding rockets in various locations and throughout all the seasons.	1. Cosmic radiation measurements have been made in U.S.S.R. sounding rockets.
2. The cosmic ray count was obtained above the atmosphere with counters in Explorer satellites and Pioneer probes.	2. The cosmic radiation was measured in Soviet satellites and space probes.
3. Cosmic ray counts in the first Explorers gave discovery of the Radiation Belt.	3. Sputnik II observations showed an increase in counting rate with height (this being at the time, an unrecognized hint of the presence of the radiation belt).
4. Details on the cosmic radiation as a function of time and position in space have been obtained from Explorer VI, and are being obtained from Explorer VII.	4. Sputnik III and cosmic rockets provided measurements on the heavy nuclei in the cosmic radiation.
Radiation Belt	
1. Radiation belt discovered with instruments in Explorer I.	1. Abnormally high cosmic ray counts were observed in Sputnik II, particularly at the high latitudes. Sputnik III showed a very high electron flux in the northern latitudes.
2. A great amount of additional detail obtained on belt in Explorers III and IV, and the Pioneer probes. Extent of radiation belt shown by Pioneer I. Pioneer III showed belt to consist of at least two zones.	2. Sputnik III, Mechta, and other Soviet satellite and space probe observations confirm the U.S. findings.
3. Pioneer IV showed the extent of the outer radiation belt to have increased greatly following a five-day period of high solar activity, thus proving that the outer belt is of solar origin.	3. N.C.

(*Continued on page 70*)

American Programme

In the United States, sounding rockets have been used for upper-air research since 1945, involving such rockets as WAC-Corporal, V-2, Viking, Aerobee, Aerobee-Hi, Nike-Deacon, Nike-Cajun, Nike-ASP, etc. Many hundreds of rockets were fired before the International Geophysical Year began in January, 1957, but altitudes attained were generally below 200 miles.

An exception was the Bumper project, a two-stage rocket developed from V-2 and WAC-Corporal, which achieved a height of 242 miles in February, 1949, but this had no direct connection with upper-air research. It did, however, point the way to the development of small step-rockets for satellite launching.

An additional 200 rockets were launched as part of the I.G.Y. programme, and the current rate of rocket soundings is somewhat below 100 per year.

A similar high-altitude rocket programme has been carried out by the U.S.S.R., although the precise number of firings is unknown. Clearly, however, they must run into hundreds, and firings have been made from Franz Josef Land and from Mirny in Antarctica, as well as from European Russia.

The Russians have developed a meteorological sounding rocket which they use for more or less routine soundings of the atmosphere, to measure air pressure, densities, and temperatures up to 35 miles altitude. In addition, their "geophysical rocket" is capable of carrying payloads of 1¼ tons to altitudes of 300 miles.

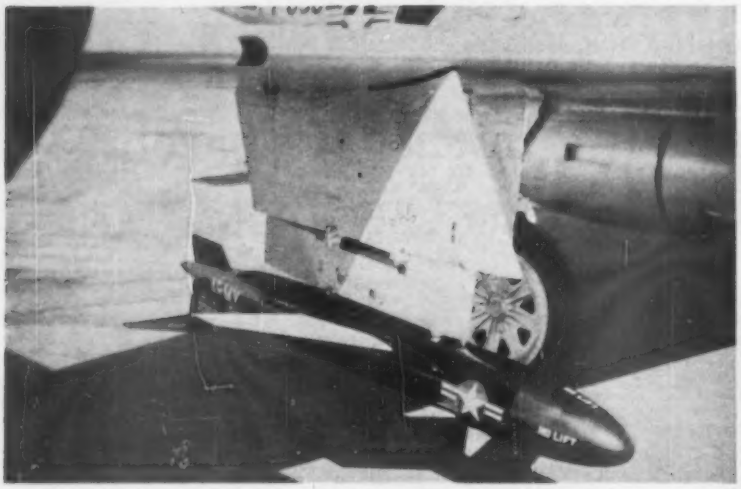
From their sounding rocket programme, Soviet scientists have obtained a broad collection of results. The meteorological soundings have produced information on the structure of the upper atmosphere just above the troposphere, showing its temporal and seasonal variations. The geophysical rocket programme has provided considerable data on the atmosphere at very high altitudes, including the ionosphere.

According to Mr. Newell, one of the geophysical rocket payloads is so similar to that of Sputnik III that the payloads may have been essentially the same. Whether or not this was the case, the instrumentation provided for a broad range of measurements of the ionosphere,

(*Continued on page 70*)

† "U.S. and U.S.S.R. Space Science Results," issued by NASA.

Satell



TOP TARGET.—Above, after launching from a jet-fighter, the U.S. Army RP-76 rocket-powered radio-controlled target aircraft has flown at a height of 61,800 ft. It is produced by the Radioplane Division of Northrop Corporation.

SQUASHED SATELLITE.—Above, flight package of the 100-ft. dia. inflatable satellite being developed by NASA's Langley Research Center for experiments in long-range radio communication. It has a potential application also as a lunar probe.

ATLAS ALOFT.—Below, tipped with an operational-type nose-cone, another Atlas ICBM takes off from Cape Canaveral on a routine test.

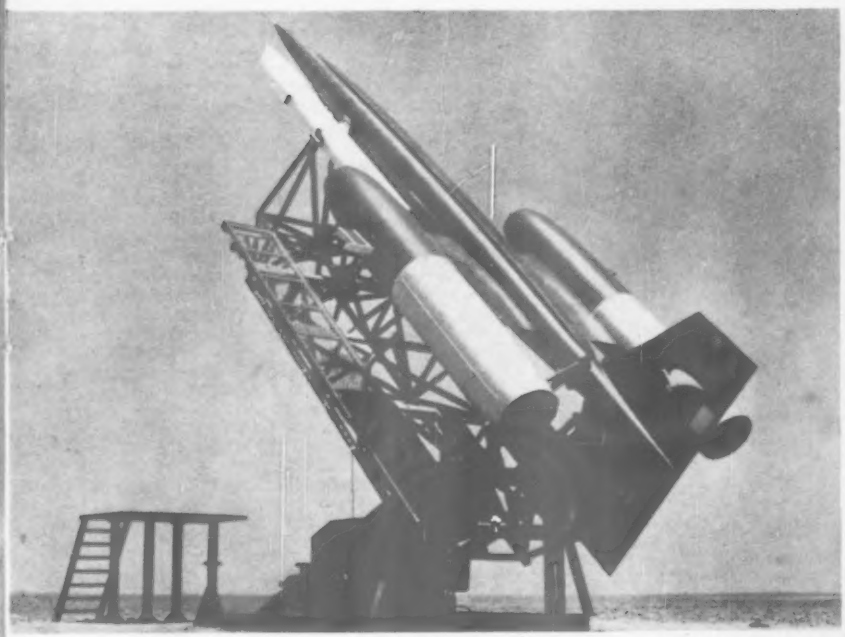
RE-ENTRY CONE.—Above, the operational-type nose-cone, for the Atlas, developed by General Electric, stands 12-ft. high. It is designed for heavier nuclear payloads, faster re-entry and greater accuracy.

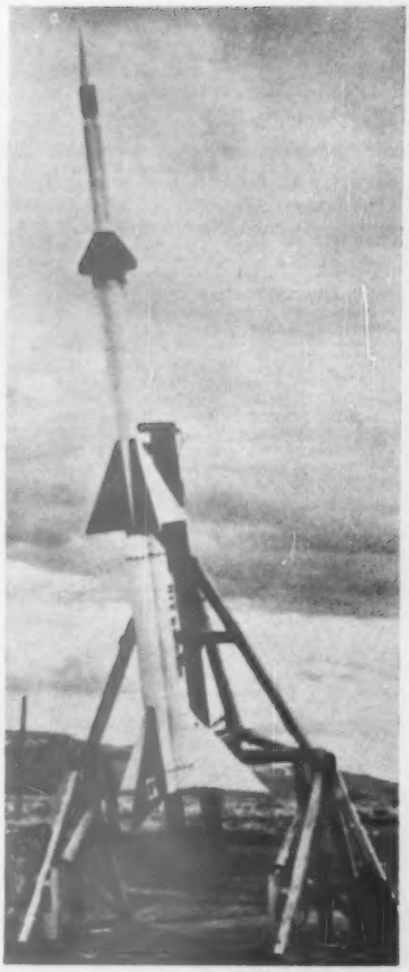
GROUNDED MERCURY.—Above, up of the Mercury space capsule been produced for testing the anter Collins Radio Company, Cedar

IN STORE.—Left, one-sixth sca complete storable rocket engine b the Jet Propulsion Laboratory for t NASA Centaur space-vehicle. (T chamber was illustrated in our issue

ON GUARD.—Right, Thor IRBMs operational in Britain, following th personnel in the United States. T Thor squadrons, each with a comple

ites, Targets and Missiles





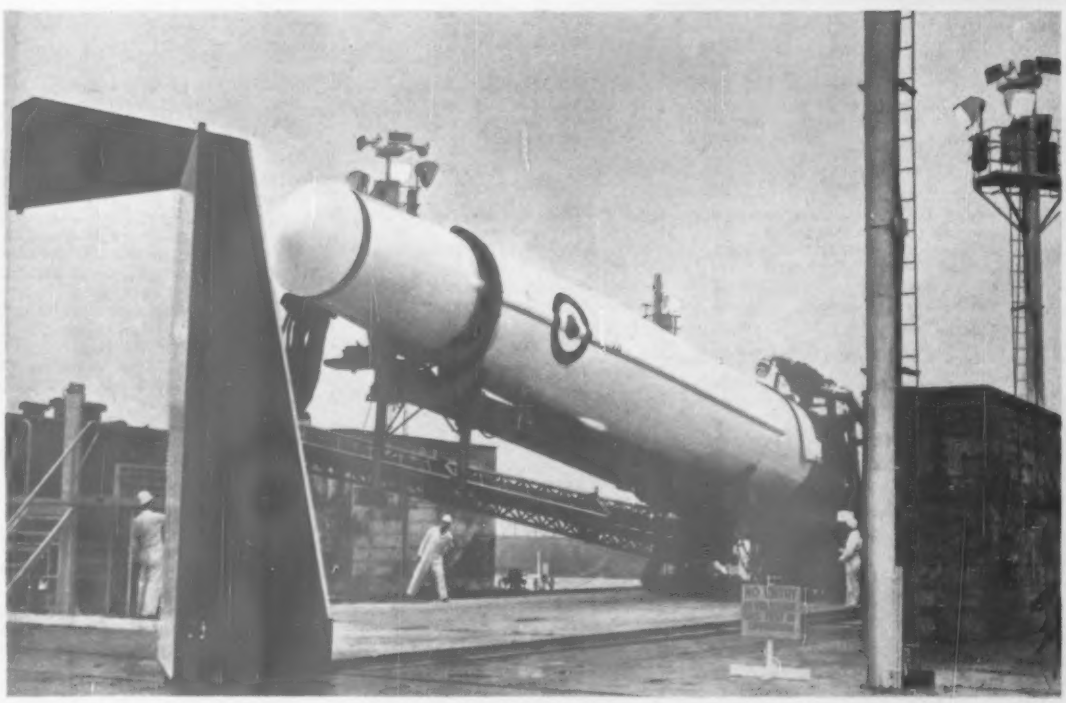
RAMJET TARGET.—Above, a licence to build and service the Nord CT-41 supersonic target-plane has been obtained by Hawker Siddeley Aviation. Twin Nord ST-625 ramjets power the fast-flying target which is ramp-launched with the aid of two solid boost rockets.

HOT ROD.—Right, on the launching pad at Holloman A.F.B. is the three-stage HTV-2 rocket which reaches a velocity of Mach 10 within 10 sec. of firing. The solid-fuelled test-vehicle is built by the Curtiss-Wright Corporation.

this full-size mock-
configuration has
na arrangement at
Rapids, Iowa.

le model of the
eing developed by
he top stage of the
he full-size thrust-
of January 1, 1960.)

have now become
training of R.A.F.
The R.A.F. has four
ment of 15 missiles.



U.S.A.	U.S.S.R.
Radiation Belt—*continued from page 67*	
4. Argus experiments showed individual inner zones of the radiation belt to be very stable.	4. N.C.
5. Argus observations lend support to conclusion that inner radiation belt was produced by cosmic rays. See No. 7.	5. N.C.
6. Detailed energy spectrum of radiation in radiation belt was obtained by Explorer VI.	6. N.C.
7. Sounding rocket observations showed that the energetic particles of the inner radiation belt are protons of energy spectrum expected from β decay of neutrons, hence supports cosmic ray origin for hard components of inner belt.	7. N.C.
8. Extensive additional information on the radiation belt was obtained from Explorer VI and is being obtained from Explorer VII and Vanguard III. High variations of many orders of magnitude in counting rates were observed in outer zone.	8. N.C.
9. Radiological hazard of radiation belt estimated to be not serious for a direct traverse of the belt; but quite serious for a space station that spends a lot of time in the belt.	9. Radiological hazard of radiation belt estimated to be not serious for a direct traverse of the belt; but quite serious for a space station that spends a lot of time in the belt.
10. N.C.	10. The Moon was shown to have no radiation belt detectable within the sensitivity of Lunik instruments.
Aurora	
1. Rocket soundings have been used to study the electromagnetic and particle radiations in the aurora. It was found that soft radiation flux above 40 km. was many times the primary cosmic ray count.	1. N.C.
2. N.C.	2. A very high flux of low energy electrons was observed in Sputniks II and III. This flux was taken to be the cause of the very high atmospheric temperature in these regions.
3. The particles in the outer radiation belt have been shown to be the likely immediate cause of the aurora.	3. The particles in the outer radiation belt have been shown to be the likely immediate cause of the aurora.
Geodesy	
1. Vanguard I observations give an oblateness of the Earth of 1/298.3.	1. N.C.
2. Vanguard I observations show the Earth to be pear shaped with a 50-ft. peak at the north pole, and a 50-ft. flattening at the south pole; this appears to imply an internal strength to the Earth, rather than a free flowing plasticity.	2. N.C.
Meteors	
1. A fairly low count of micrometeors corresponding to a total influx of 1,000 to 10,000 tons of material per day, from Explorer and Pioneer observations.	1. Influx of material per day indicated by Sputnik III observations in general agreement with the U.S. results.
2. A very large amount of additional data was obtained from the Vanguard III instrumentation.	2. Additional measurements made in Soviet cosmic rocket flights.
Astronomy	
1. In sounding rocket experiments ultra-violet sources in the sky have been detected and plotted.	1. N.C.
2. The Solar spectrum has been observed and photographed down to 303 Angstroms.	2. N.C.
3. Solar radiations have been observed and measured in the X-ray regions.	3. N.C.
Lunar Explorations	
1. N.C.	1. First photos taken of the hitherto unseen side of the Moon.
2. N.C.	2. The lunar magnetic field shown to be no greater than 50 gamma.
3. N.C.	3. Lunar ionosphere detected.

(*Continued from page 67*)

atmospheric structure, energetic particles, and the Earth's magnetic field.

The Soviet rocket programme has also included considerable biological studies. There have been at least 20 experiments in which dogs, and/or rabbits, were sent aloft and recovered for study.

At the time of writing, the U.S.S.R. has successfully launched three Earth satellites and three space probes. Two of the probes achieved "escape velocity"; the first passed within 4,000 to 6,000 miles of the Moon. The second Soviet probe actually hit the Moon. The third space probe was launched so as to pass close enough to the Moon to take pictures of the unseen side, then to loop around the Moon and return to the neighbourhood of the Earth.

The United States has to date successfully launched 15 Earth satellites in 31 attempts—five Explorers, three Vanguards, Project Score, and six Discoverers. In addition, six space probes have been launched, only one of which achieved its mission, passing the Moon at a distance of about 37,000 miles. Others reached distances of 70,700 and 63,580 miles from Earth and were useful on that account.

Diverse Results

It is evident that both United States and Russian satellites and space probes have produced valuable scientific results. In the case of the American upper atmosphere programme, a number of "firsts" may be listed covering a wide range of interests.

These include the first detailed photograph of the solar ultra-violet spectrum; the first photograph of a complete tropical storm; the first penetration of equatorial ionospheric current sheets; and the first detection of X-rays in the upper atmosphere. Then came the discovery of the Van Allen radiation belt, and the further discovery that the radiation belt consists of at least two zones.

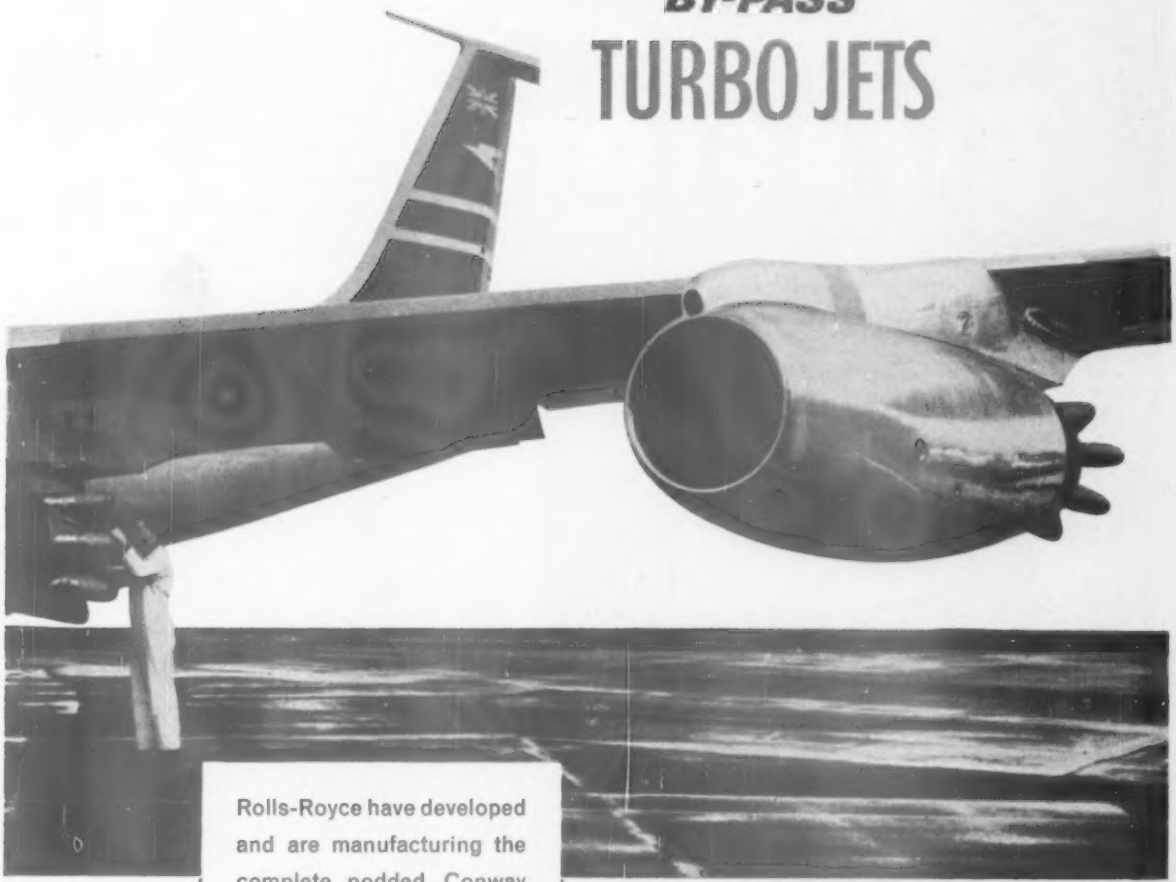
With Vanguard I, the first precise geodetic use of artificial satellites enabled the first refined information to be obtained on the size and shape of the Earth, providing an improved value for the "flattening" and showing that the Earth is actually slightly pear-shaped. Project Argus showed the effect on the radiation belts of nuclear explosions in space, and finally, in Project Score, the first use was made of an elementary "active" communications satellite.

In the Soviet case, initial achievements stand out more clearly in vehicle development, greater available performance and heavier payloads. Thus, we have the first artificial Earth satellite, the first lunar near-miss (and artificial planet), first lunar impact, first pictures of the Moon's hidden face, first routine recovery of large animals (dogs and rabbits) from high-altitude research rockets, and the first launching of a large animal (Laika) in an Earth satellite.

The Russians, in addition, have developed for routine use a meteorological sounding rocket which is recoverable and re-usable. In the field of physics, they can claim to have first detected what may be a current ring about the Earth (the Chapman- Størmer ring), and they have of course amplified

(*Continued on page 71*)

ROLLS-ROYCE
CONWAY
BY-PASS
TURBO JETS



Rolls-Royce have developed and are manufacturing the complete podded Conway installation, including the thrust reverser and silencer, for the Boeing 707-420.

CONWAYS HAVE BEEN ORDERED TO POWER THE BOEING 707-420's OF—

Air India International
British Overseas Airways Corporation
Lufthansa · Varig of Brazil

THE DOUGLAS DC-8's OF—

Alitalia · Canadian Pacific Airlines
Trans Canada Air Lines

AND THE VICKERS VC. 10's OF—

British Overseas Airways Corporation

ROLLS-ROYCE LIMITED, DERBY, ENGLAND

AERO ENGINES · MOTOR CARS · DIESEL AND PETROL ENGINES · ROCKET MOTORS · NUCLEAR PROPULSION

Many jet services land on
Firestone
high-speed ribbed
Sky Champion tyres

B·O·A·C
TWA
QANTAS
AIR-INDIA International

FIRESTONE TYRE & RUBBER COMPANY LIMITED, GREAT WEST ROAD,
BRENTFORD, MIDDLESEX. A.I.D. A.R.B. & C.A.A. APPROVED

(*Continued from page 70*)

and extended research on the radiation belts and other phenomena affecting the Earth in space.

Over and above all else, however, they have demonstrated with Lunik III the first manœuvrable, heavily instrumented, space vehicle with fully successful long-range communications. So many advanced techniques have been combined in this one probe that one can foresee not only the development of inter-planetary probes, extending the field of investigation to Mars and Venus, but the application of the same basic principles in Earth satellites for radio and TV communication and TV weather survey, for example.

Indeed, in view of the progress the Russians have made, it is surprising that no more purely Earth-satellites have been launched since Sputnik III in May, 1958.

Comparative Studies

In attempting to compare the relative merits of the United States and Russia in space research, it is most helpful to isolate the general areas of investigation and the general problems being attacked by the two countries. This has been done in the accompanying NASA table.

On balance, the United States and Russia appear to be at about the same stage of advancement in upper-air research. More detailed results are available on the atmosphere below 200 miles from U.S. research, but the Russians have made measurements at higher altitudes with their geophysical rockets.

In the study of solar radiation, Russia appears to have done far less than the United States but, on the other hand, has apparently achieved more in biological research of the kind in which dogs have been recovered from high-altitude rockets. However, America has lately achieved good success with the recovery of nose-cones from ballistic rockets, some of which have contained monkeys.

In the recovery of data, the Russians seem to have concentrated more, in the early stages, on the ejection of instrument packages from the carrier rockets while, in the United States, greater attention has been paid to the development of telemetering. Nevertheless, Lunik III demonstrated telemetering skills of a high order and Russian scientists appear to have broken through to a new plateau—formerly exclusive to the Americans—of miniaturization.

There is evidence, too, that circuits have been duplicated to achieve higher standards of functional reliability. This may be one of the secrets behind the success of Sputnik III which has continued to broadcast effectively for more than 1½ years.

In studies of the Earth's environs, the U.S.A. and the U.S.S.R. seem to be more or less on equal terms, although America may have the slight edge because of the diversity of the research equipment employed. This has been facilitated by the greater frequency of satellite launching in the United States which has enabled a series of more complex experiments to be attempted, step by step.

In deep space research, the U.S.S.R. has clearly taken the lead, a situation which is directly attributable to the possession of launching vehicles of higher overall performance.

U.S.A.	U.S.S.R.
Miscellaneous Experiments	
1. The Argus experiments demonstrated the effects of nuclear explosions in space.	1. N.C.
2. Sodium vapour was released in the high atmosphere and observed to measure its radiations, atmospheric winds, and diffusion.	2. Sodium clouds were released from Luniks II and III and observed from the ground.
3. Various chemical contaminants were released in the high atmosphere to study the photochemical reactions that resulted.	3. N.C.
Biosciences	
1. On numerous sounding rocket flights biological specimens of seeds, fruit flies, etc., have been flown and recovered for study. Larger animals, such as rats and monkeys, have been flown for study of their behaviour and the effects of the flight environment on them. Recovery of such animals has been effected on numerous occasions.	1. Large numbers of sounding rocket experiments have been carried out with dogs and rabbits, in which the animals were both studied during flight and recovered after flight for further study.
2. N.C.	2. Observations were made on the behaviour of Laika, particularly heart-beat and respiration, in Sputnik II.
Engineering Data	
1. U.S. satellites show that moderate temperatures can be achieved in orbiting vehicle.	1. U.S.S.R. satellites and space probes show that moderate temperatures can be maintained by appropriate engineering.
2. Elementary communications link tested in Project Score.	2. N.C.
3. Based on radiation belt data, it is deduced that satellites may charge to a potential of some hundreds of volts in the radiation belt.	3. Sputnik III measurements show that in the daytime ionosphere the satellite acquired an appreciable negative charge corresponding to a negative potential of several volts.
4. The meteor erosion and puncture problems have been shown in general to be not particularly serious.	4. The meteor erosion problem appears to be not particularly serious.
5. An elementary TV scanner was tested in Explorer VI, while some of the basic elements of a meteorological satellite were tested in Vanguard II.	5. N.C.
6. N.C.	6. Automatic photography of the Moon and the televising of the photographs back to Earth achieved.
7. Solar cells have been established as a practical, reliable source of power.	7. Solar cells have been established as a practical, reliable source of power.
8. N.C.	8. A complete spacecraft, manœuvrable with temperature control, power supply, long-range communications link, complicated instrumentation, etc., has been engineered and launched successfully, namely, Lunik III.
9. It appears that the radiological hazard to space vehicle crews traversing the radiation belt directly may be relatively low, while the hazard to those in a satellite orbiting through the radiation belt would be quite serious. In addition, marked increases in proton intensities of the cosmic radiation found at the time of solar activity may be a very serious radiological hazard: dose rates of 1,000 r/hr.	9. It appears that the radiological hazard to space vehicle crews traversing the radiation belt directly may be relatively low, while the hazard to those in a satellite orbiting through the radiation belt would be quite serious.
Meteorology	
1. Numerous sounding rocket photographs of cloud formations and significant weather areas have been taken. In particular a composite photograph from one sounding rocket showed a completely developed tropical storm approaching hurricane proportions.	1. N.C.
2. N.C.	2. A meteorological sounding rocket was developed and has been used on a routine basis for meteorological studies.
3. N.C.	3. Detailed measures of pressures and temperatures have been obtained with the meteorological rocket for Antarctic, Arctic, and Middle European locations.
4. Cloud picture data were obtained in Vanguard II, but motions of the satellite have so far prevented reduction of data to useful pictures. Also, very low resolution, elementary television, pictures have been taken of cloud formations as seen from Explorer VI. One of these pictures was assembled and released.	4. N.C.

B.O.A.C. Introduces the Boeing 707

IN the latter half of April, B.O.A.C. expects to fly its first Boeing 707 service across the North Atlantic. This event will bring to fulfilment some four years of planning and preparations which began with the management's decision to purchase the Boeing transports and subsequently spread out to involve every part of the Corporation's organization. Delivery of the first of the fleet of 15 Conway-engined Boeing 707-436s on January 30 at London Airport will be the signal for the last vital stage of preparations to begin.

When B.O.A.C. announced, in October, 1956, that Government permission had been obtained for the purchase of 707s, the chairman said that the plan was to operate them "on routes between Britain and the eastern seaboard of the U.S.A.; between Britain and Canada; between Britain and the west coast of the U.S.A., possibly across the polar region; and, subject to Government approvals, from Britain over the North Atlantic, the U.S.A. and the Pacific, to Australia." This plan has not been changed in any way and is likely to be fully implemented by the middle of 1961 if the necessary U.S. approval for the trans-Pacific route to Australia is obtained without delay.

The 707s will be operated in multi-class configuration, although the precise details will not be fixed until the situation over fares and classes on the Atlantic routes after April 1 is clarified. Typical configurations proposed are 36 de luxe (42-inch pitch) and 97 economy (34-inch pitch) seats, or 50 de luxe and 63 economy. B.O.A.C. is anxious to retain the tourist class also, since it believes that a substantial demand for this class is generated in the U.K. and Europe, whereas the demand for economy class is largely generated in North America.

Whilst it may be comparatively easy to assess the likely overall demand for each class of travel, deciding the actual cabin configurations—which can have almost endless permutations of one, two, three, or four different classes—is a highly skilled exercise. A nicety of judgment is called for if passengers are not to be turned away from one class while seats remain unsold in another, and if valuable aircraft time is not to be lost on the ground through frequent configuration changes. Responsibility for decisions of this kind rests, in B.O.A.C., with the central planning committee (C.P.C.), which includes representatives of the three route groups (western, eastern and southern), the engineering and flight operations departments, and economics and tariff departments.

Meeting at least once a week and maintaining a constant liaison between all the departments concerned with future plans, the C.P.C. has specific short-term and long-term forecasting tasks, the latter covering periods of up to 10 years ahead. The Boeing 707 order followed a C.P.C. forecasting exercise on the Western routes in 1956, which showed that, without new equipment, the Corporation would be unable to hold a competitive position on the North Atlantic routes after 1959-60.

Passengers for the first-class cabin go aboard through the forward main door. This posed photograph at Renton anticipates B.O.A.C. Jetliner 707 operations which are to begin in April.

With the help of its own market research unit, the C.P.C. estimates the likely traffic volumes and capacity requirements, and indicates when and where new aircraft are likely to be needed. In the case of this particular exercise it was assumed that 50% of the total air traffic between the U.K. and North America would be carried by B.O.A.C. by the early 'sixties (the figure was below 30% at the time of the study and is now about 43%).

The task of examining new aircraft projects against the future requirements shown by the C.P.C. forecasts is in the hands of an aircraft evaluating committee, with the final choice being left to the chairman's top-level aircraft requirements committee. In the case of the Boeing 707, the requirements were clearly defined and, the Vickers V.1000 having been abandoned in 1955, the choice lay between the 707 and the DC-8. The size of the order was, however, a matter for

negotiation with the Treasury, and it now appears that B.O.A.C. may once again be short of capacity on the Atlantic for a year or so before the Vickers VC10s come into service in 1964.

As soon as the contract for 707s was placed, a special unit was set up in B.O.A.C. to look after the project, and the 707 Project Engineer became—and still is—the key individual handling all communications between the Corporation and Boeing Airplane Co., 5,000 miles away at Renton, Washington. With vendor and customer so far apart, it became especially important to ensure that all correspondence in each direction went through a single channel to avoid duplications and misunderstanding.

Contract Details

As is the practice with U.S. manufacturers, Boeing offered B.O.A.C. a basic aeroplane at a fixed price, with subsequent customer changes the subject of negotiated extra charges. The work of initiating the inevitable "change requests" (of which there have been about 150, not all of them accepted) and negotiating the cost of such of these requests which were agreed as "master changes," was an important part of the project engineer's job, especially in the earlier days of the programme.

The basic aeroplane offered by Boeing was the 707-420 with Rolls-Royce Conway engines. The changes initiated by B.O.A.C. have mostly been of a minor nature—to introduce British accessories and to conform with B.O.A.C. standards. Two items of particular interest are a humidification system on the flight deck and Bendix engine vibration and burner monitors. The latter, which might be compared in importance to the ignition analysers on a piston engine, detect burner malfunctioning or excess engine vibration and present the information on a cathode-ray tube at the flight engineer's panel.

At an early stage in the project, B.O.A.C. appointed a plant representative and a liaison engineer at Boeing to handle general queries on the spot. As work progressed, they have been joined by a total of five inspectors, whose job is to maintain quality control on the shop floor and accept the aircraft at every stage of construction. In the reverse direction, Boeing has appointed two service representatives to B.O.A.C. for two years.

Spares Pooling

Ahead of delivery of the first aircraft the spares backing must be built up. Deciding the quantities and types of spares to be purchased was another of the important tasks of the engineering branch, working through the project engineer. In the course of spares procurement, a unique spare-parts pooling arrangement has been made with Air France, Pan American, T.W.A. and Qantas.

Under this arrangement, each airline is responsible for an agreed list of user spares and tools in its own "area of responsibility," and provides these spares as necessary to the other airlines. B.O.A.C. is responsible for 707 spares for all five operators at London, Goose, Keflavik, Shannon, Prestwick, Montreal and Hong Kong. The pool investment in spare parts at overseas stations is a little over $500,000, saving nearly 70% of what would have been the total individual commitment.

Another early planning requirement is the maintenance schedule, which directly influences the utilization of the aircraft. Much of this planning has to be based on estimates by engineering specialists of what needs to be done to each system and the whole structure, and the time likely to be taken. These preparations are undertaken in collaboration with the facilities planning department, which has the job of deciding on the special equipment and tools which will be needed.

In the case of the 707, and having regard to the routes on which it will be flying, the checks will be at 67 hours (check A), 200 hours (check B) and annually (check C), with any interim requirements added to the appropriate checks (e.g., 1,000-hour items can be dealt with on check B5). Estimated durations and man-hours for these checks are: A, 8 hr. and 200 man-hours; B, 20 hr. and 600 man-hours; and C, 10 days reducing to 7 days and 7,000 man-hours. In addition, the check at each end of the route will require 3 hr. (excluding towing time) and 100 man-hours.

Before the operations planning department can get to grips with the scheduling of a new aircraft type it needs to know not only the maintenance times, but also the operational procedures. These are established by the operations engineering department, which writes the operations manual in collaboration with the flight operations personnel. So far as the 707 is concerned, B.O.A.C. has been able to "read across" from its experience with the Comet. Thus, for instance, because in practice about 80% of all Comet flights across the Atlantic have been allowed to operate a cruise-climb flight plan, this same technique will be used as the basis of 707 operations. The cruise will be flown on the height lock—since a practicable Mach lock is not yet available—and height will be increased by 300-400 ft. about twice every hour to keep constant an indicated Mach number.

Taking into consideration the maintenance requirements, operating techniques, runway lengths and strengths, average winds and temperatures, and required arrival punctuality factors, operations planning produces—miraculously to the uninitiated—time-tables, flying times and sector payloads (on a monthly basis) and utilization charts. These, in turn, provide a basis for the crew establishments, which must take into account flight-time limitations, industrial agreements, crew-training programmes—and the need to keep the existing fleets operating at full strength while crews are trained on the new type.

Utilization Target

Within a year of putting the 707 into service, B.O.A.C. plans to achieve an annual aircraft utilization rate of 3,400 hours. The peak daily utilization in the summer of 1961 will be over 11 hours a day, the actual value depending upon the limitations imposed on night jet operations at London Airport. On the routes which B.O.A.C. plans for the 707, lack of runway length is likely to impose a penalty only at London Airport, until the 10R/28L runway there has been extended to 11,000 ft.

No less important than the engineering and operational planning is the preparation for crew training. A 707 flight manager was appointed in July, 1958, and has been responsible, with his deputy and the 707 training captain, for all matters concerned with crew training and crew aspects of the 707 in general. His first task was to select instructors and supervisory captains, without whom the training programme cannot get

The first of B.O.A.C.'s Boeing 707s shares hangar space with a T.W.A. Intercontinental and two B-52s while undergoing maintenance at Seattle.

under way. Despite the Corporation's long lead in jet operations, there is a paucity of jet-experienced captains available for the 707, since it is not economical to transfer crews wholesale from the Comet, and the 90 crews required by April 1, 1961, will be selected by seniority bidding from all B.O.A.C. flights.

Training Programme

The training of 707 instructors (of which there will be a maximum of nine, plus 11 supervisory pilots for route clearances) began in October, 1959, by which time the Link moving-base simulator had arrived at the Central Training Unit at Cranebank, and had been checked out by two Boeing pilots. The training programme has been established at 40 hours on the simulator for each captain and co-pilot operating as a crew, 26½ hours' flying (made up of 16½ hours for the captain and 10 hours for the co-pilot) and two round trips across the Atlantic on route training. The six-week ground course includes four weeks on engines and airframes, a week on flight planning and performance, and a week on radio, rescue procedures and so on.

It is likely that 2,500 hours of flying training will be needed to train the first 90 crews, and an early requirement was to find a suitable airfield, offering round-the-clock operation, a 9,000-ft. runway, full lighting and VOR, ILS and radar markers. Of the very few airfields in Britain meeting these requirements, the R.A.F. Coastal Command station at St. Mawgan, in Cornwall, has been chosen, and two Boeing 707s will be based there for training from March onwards. One of the incidental problems of this particular operation was to provide for 150,000 gallons of fuel a week to be available at St. Mawgan—no mean feat in itself.

Many other departments in B.O.A.C. have inevitably been drawn into the preparations as the inaugural service date draws nearer. Cabin services and passenger services, for instance, have been closely concerned with the cabin arrangements, provision of galleys, selection of seats and so on. Within the commercial department, the sales development, traffic and advertising groups are beginning to build up the pressure through advertising campaigns and direct mailing, to be supplemented by inaugural flights for travel agents and others when aircraft become available. The press branch plays its part by promoting publicity on the Boeing 707.

When the contract for Boeing 707s was signed the delivery date for the first aircraft was specified at the end of December, 1959, followed by one a month from February to September, 1960, and two a month in October, November and December. The first flight of the 707-436 (the first 707 with Conway engines) was made on May 19, 1959, and the F.A.A. portion of the certification tests proceeded smoothly and ahead of schedule.

Before validating the American C. of A. the British A.R.B. asked for compliance with 22 special conditions, some of which required additional flight testing. In particular, the A.R.B. has been concerned over the consequences of the aircraft being "rotated" too soon or too far during take-off. These tests, and some modifications which have been indicated as a result, have put back initial deliveries by a few weeks, but are not expected to delay the aircraft farther down the line.

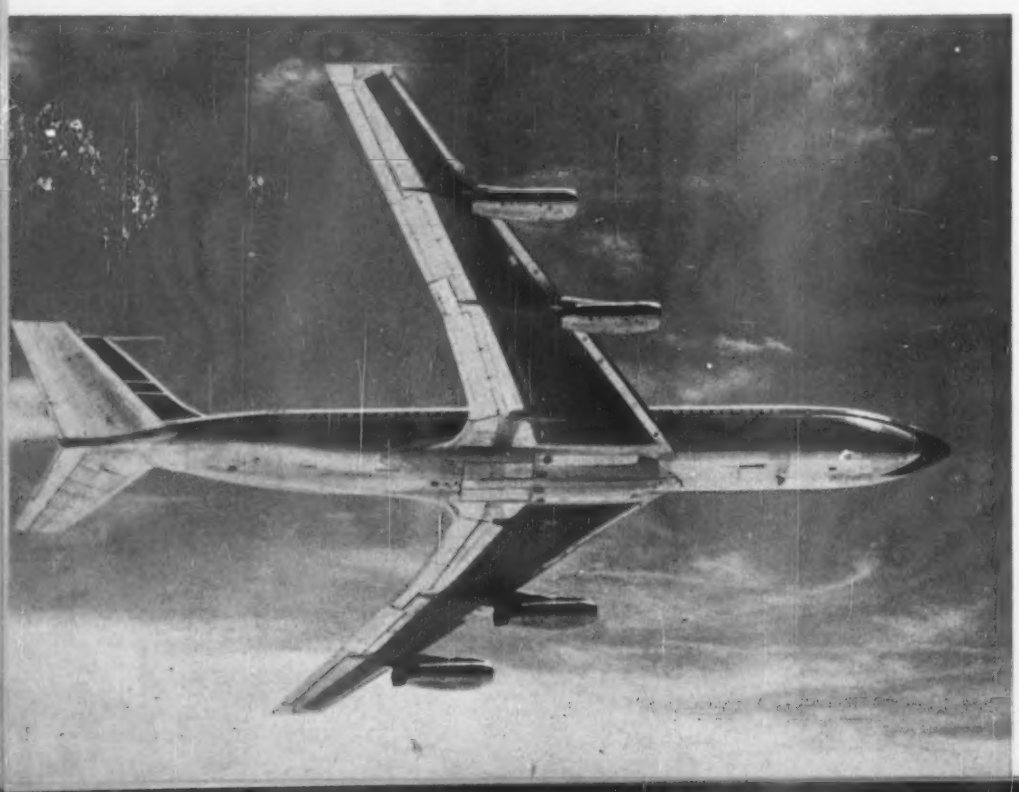
Inside the forward freight hold of the B.O.A.C. 707— a view which emphasizes its spaciousness.

Service Plans

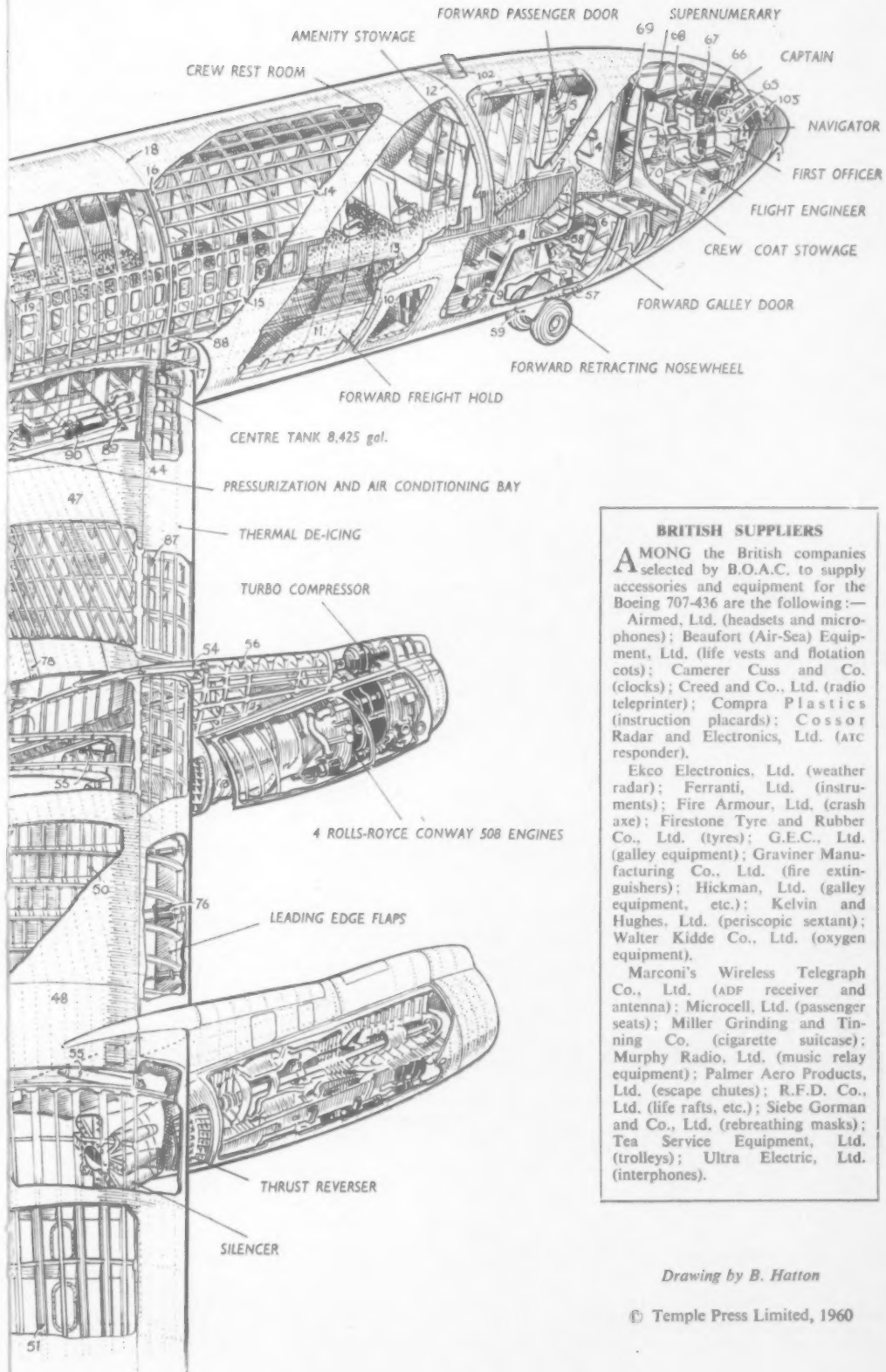
Provided there is no serious delay in deliveries, the Boeing 707s will be in service in time for the early summer peak in Atlantic traffic. Three services a week will be flown at first between London and New York, plus one a week to Montreal and Toronto. The New York service will increase to a daily frequency in May and the Canadian service will become daily in July.

Additional services to New York, starting in July, will call at Prestwick and there will be a twice-daily frequency to New York in August. A thrice-weekly service will be introduced to Detroit and Chicago in September. In that month, too, a twice-weekly service will go through New York to San Francisco, and in November these services will be further extended across the Pacific via Honolulu to Tokyo and Hong Kong. In February, 1961, B.O.A.C. hopes to start its first Arctic service, via Frobisher to Los Angeles, subsequently extending this service across the Pacific. Also in 1961, the 707s are expected to serve Nassau from New York, and Tel Aviv and Teheran as eastwards extensions of certain Atlantic services.

With Conway 508 engines rated at 17,500 lb.s.t. each, the B.O.A.C. 707-436 promises to be the best performer, in range and economy, of all the Boeing jet family. The thoroughness of B.O.A.C.'s preparations should ensure its smooth and successful entry into service as planned on April 20.—F.G.S.



The unpainted undersurface of the wing clearly reveals the areas of the integral fuel tanks, from root to tip between the spars. All Boeing 707-420s ordered to date—by Air India, Lufthansa and Varig in addition to B.O.A.C.—will be delivered with Conway R.Co.12s at the 17,500 lb.s.t. rating.



BRITISH SUPPLIERS

AMONG the British companies selected by B.O.A.C. to supply accessories and equipment for the Boeing 707-436 are the following:—

Airmed, Ltd. (headsets and microphones); Beaufort (Air-Sea) Equipment, Ltd. (life vests and flotation cots); Camerer Cuss and Co. (clocks); Creed and Co., Ltd. (radio teleprinter); Compra Plastics (instruction placards); Cossor Radar and Electronics, Ltd. (ATC responder).

Ekco Electronics, Ltd. (weather radar); Ferranti, Ltd. (instruments); Fire Armour, Ltd. (crash axe); Firestone Tyre and Rubber Co., Ltd. (tyres); G.E.C., Ltd. (galley equipment); Graviner Manufacturing Co., Ltd. (fire extinguishers); Hickman, Ltd. (galley equipment, etc.); Kelvin and Hughes, Ltd. (periscopic sextant); Walter Kidde Co., Ltd. (oxygen equipment).

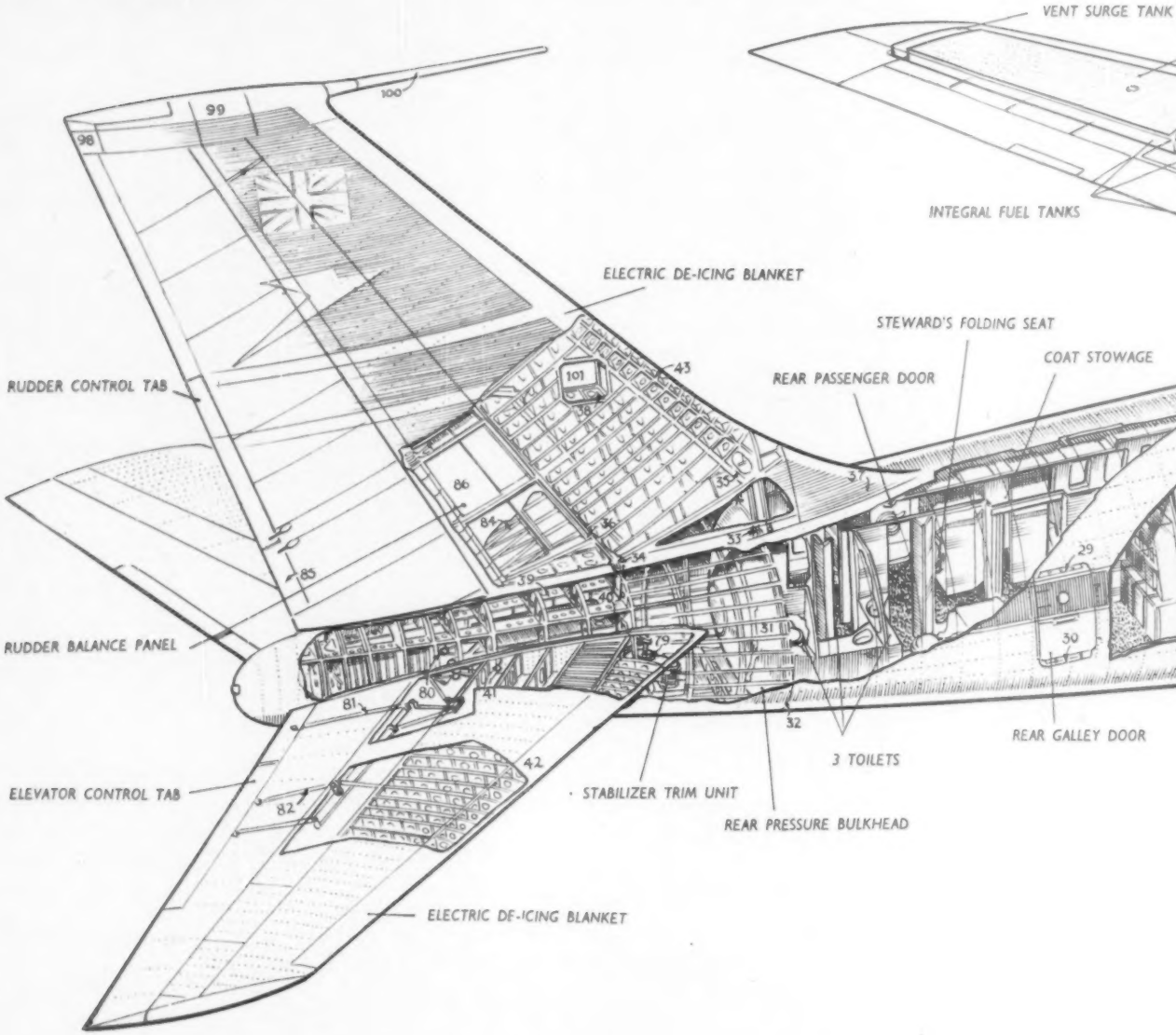
Marconi's Wireless Telegraph Co., Ltd. (ADF receiver and antenna); Microcell, Ltd. (passenger seats); Miller Grinding and Tinning Co. (cigarette suitcase); Murphy Radio, Ltd. (music relay equipment); Palmer Aero Products, Ltd. (escape chutes); R.F.D. Co., Ltd. (life rafts, etc.); Siebe Gorman and Co., Ltd. (rebreathing masks); Tea Service Equipment, Ltd. (trolleys); Ultra Electric, Ltd. (interphones).

Drawing by B. Hatton

© Temple Press Limited, 1960

The Boeing 707-436 Jet Transport

Four 17,500 lb. s.t. Rolls-Royce Conway 508 By-pass

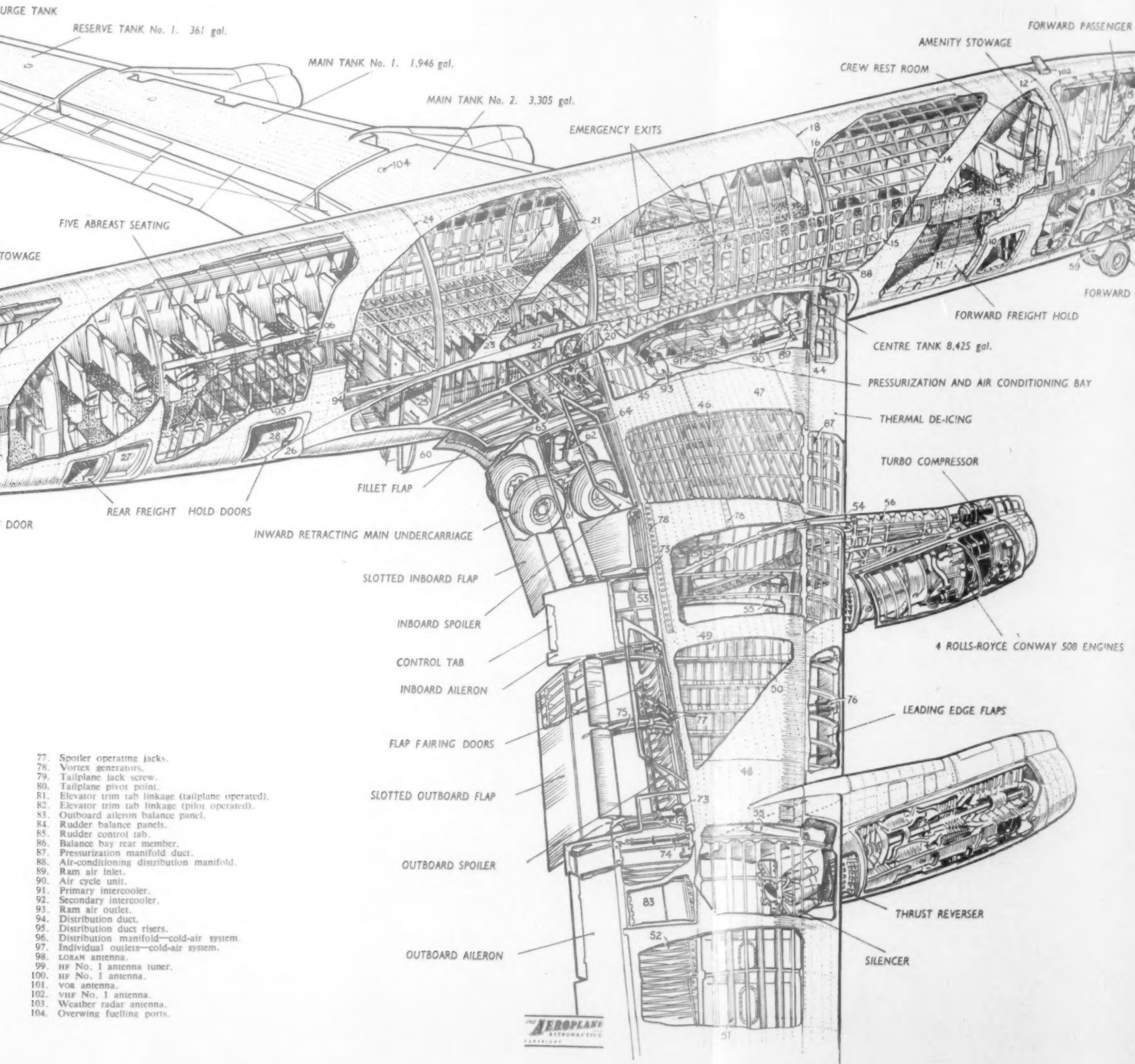


KEY

1. Radome—glass fibre.
2. Control cabin fuselage frames.
3. Eyebrow windows.
4. Control cabin bulkhead.
5. Forward passenger door, plug-type outward opening.
6. Nosewheel well (unpressurized).
7. Forward galley door, plug-type outward opening.
8. Electronic equipment bay.
9. Electronic equipment cooling duct.
10. Forward freight hold sliding door.
11. Freight hold flooring.
12. Production break.
13. Passenger compartment floor beams.
14. Fuselage stringers.
15. Window frame forgings.
16. Front spar body frame.
17. Front spar pick-up point.
18. Production break.
19. Overwing emergency exit structure.
20. Centre section floor structure.
21. Rear spar body frame.
22. Landing gear wheel bay.
23. Wheel bay floor structure.
24. Production break.
25. Rear freight hold front bulkhead.
26. Rear freight hold sliding doors.
27. Sliding door recess.
28. Rear freight hold flooring.
29. Rear galley loading plug-type door—upper gate.
30. Rear galley door—lower gate.
31. Rear pressure bulkhead.
32. Production break.
33. Fin front spar attachment.
34. Fin rear spar attachment.
35. Fin front spar.
36. Fin rear spar.
37. Fin leading edge fairing.
38. vor antenna cutaway.
39. Tailplane centre section.
40. Tailplane front spar attachment.
41. Tailplane rear spar attachment.
42. Removable tailplane leading edge.
43. Removable fin leading edge.
44. Wing front spar.
45. Wing rear spar.
46. Fuel tank access doors.
47. Inboard wing machined skin.
48. Outboard wing machined skin, tapered to wing tip.
49. Wing rib.
50. Wing rib stiffeners.
51. Fuel tank vent structural ducts.
52. Balance bay structure (outboard aileron).
53. Balance bay structure (inboard aileron).
54. Strut attachment.
55. Thrust brace.
56. Inboard engine strut.
57. Nose gear steering cylinders.
58. Nose gear retraction jack.
59. Nosewheel fairing door.
60. Undercarriage doors.
61. Undercarriage truck beam.
62. Main landing gear strut.
63. Main landing gear side strut.
64. Main landing gear drag strut.
65. Thrust levers.
66. Control column.
67. Captain's instrument panel.
68. Nosewheel steering control wheel.
69. Navigator's station.
70. Flight engineer's station.
71. Outboard flap drive unit.
72. Flap control valves.
73. Flap extension screwjacks.
74. Aileron trim tab operating jack screw.
75. Flap tracks.
76. Leading-edge flap jacks.

ort

-pass Turbojet Engines



77. Spoiler operating jacks.
78. Vortex generators.
79. Tailplane jack screw.
80. Tailplane pivot point.
81. Elevator trim tab linkage (tailplane operated).
82. Elevator trim tab linkage (pilot operated).
83. Outboard aileron balance panel.
84. Rudder balance panels.
85. Rudder control tab.
86. Balance bay rear member.
87. Pressurization manifold duct.
88. Air-conditioning distribution manifold.
89. Ram air inlet.
90. Air cycle unit.
91. Primary intercooler.
92. Secondary intercooler.
93. Ram air outlet.
94. Distribution duct.
95. Distribution duct risers.
96. Distribution manifold—cold-air system.
97. Individual outlets—cold-air system.
98. LORAN antenna.
99. HF No. 1 antenna tuner.
100. HF No. 1 antenna.
101. VOR antenna.
102. VHF No. 1 antenna.
103. Weather radar antenna.
104. Overwing fuelling ports.

BRITI
AMONG
selected
accessories
Boeing 707-
Airmed, L
phones); Be
ment, Ltd.
cots); Carl
(clocks); Cr
teleprinter);
(instruction
Radar and
responder).
Ekco Ele
radar); F
ments); Fir
axe); Fires
Co., Ltd.
(galley equip
facturing
guishers);
equipment.
Hughes, Lt
Walter Kid
equipment).
Marconi's
Co., Ltd.
antenna); M
seats); Mil
ning Co
Murphy R
equipment)
Ltd. (escap
Ltd. (life ra
and Co., L
Tea Serv
(trolleys);
(interphone
Dra
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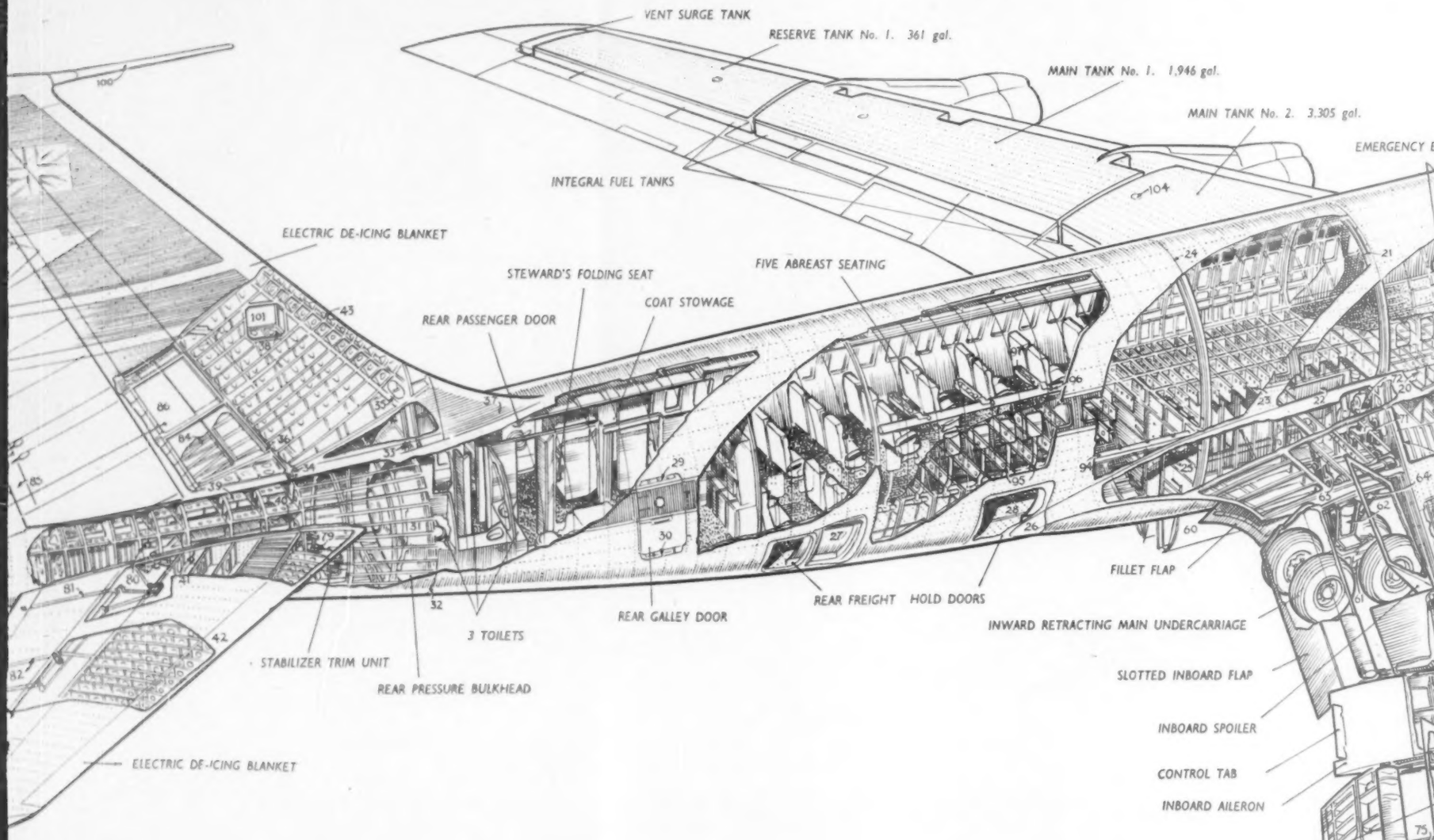
eing 707-436 Jet Transport

0 lb. s.t. Rolls-Royce Conway 508 By-pass Turbojet Engines



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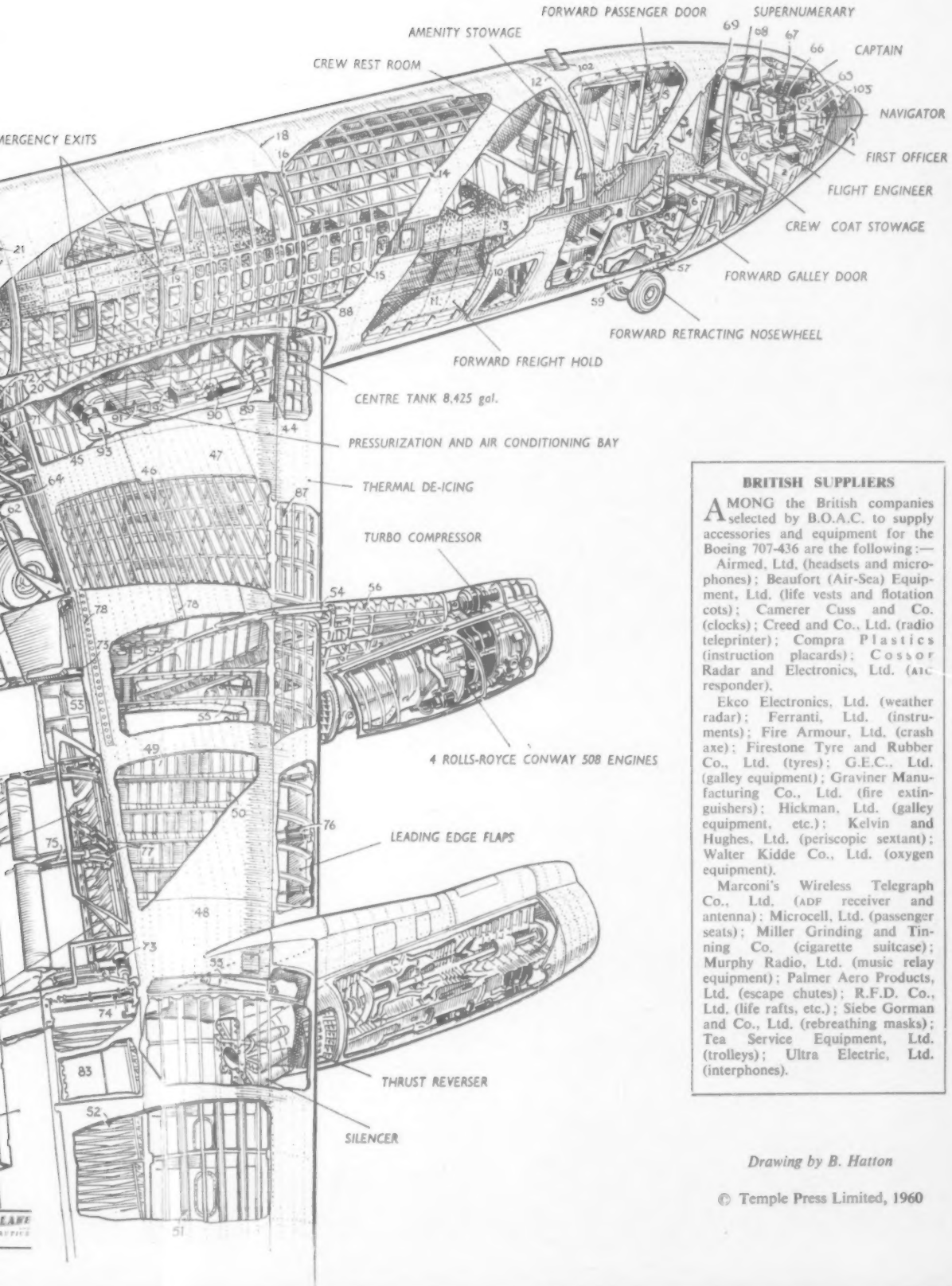

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Drawing by B. Hatton

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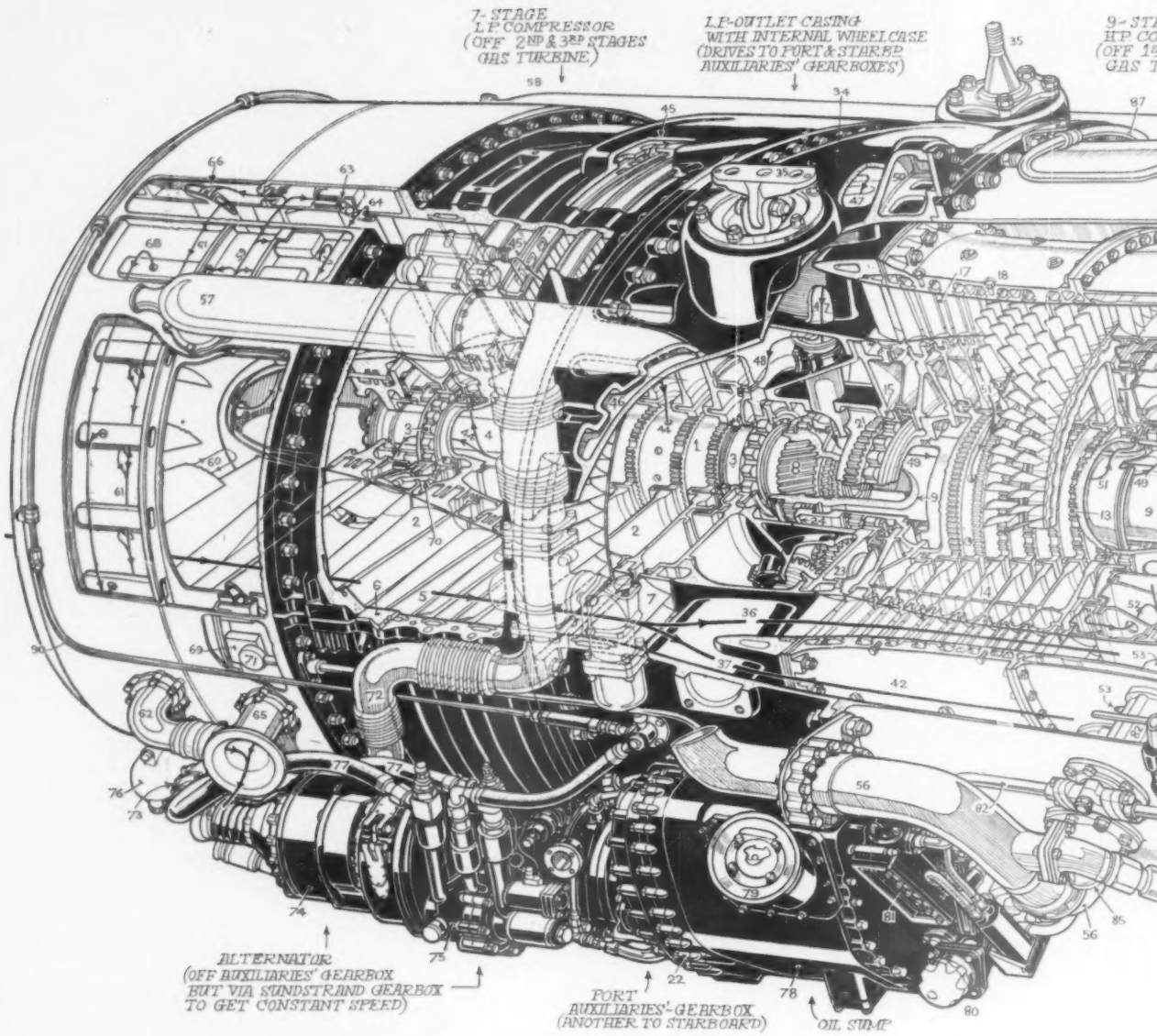
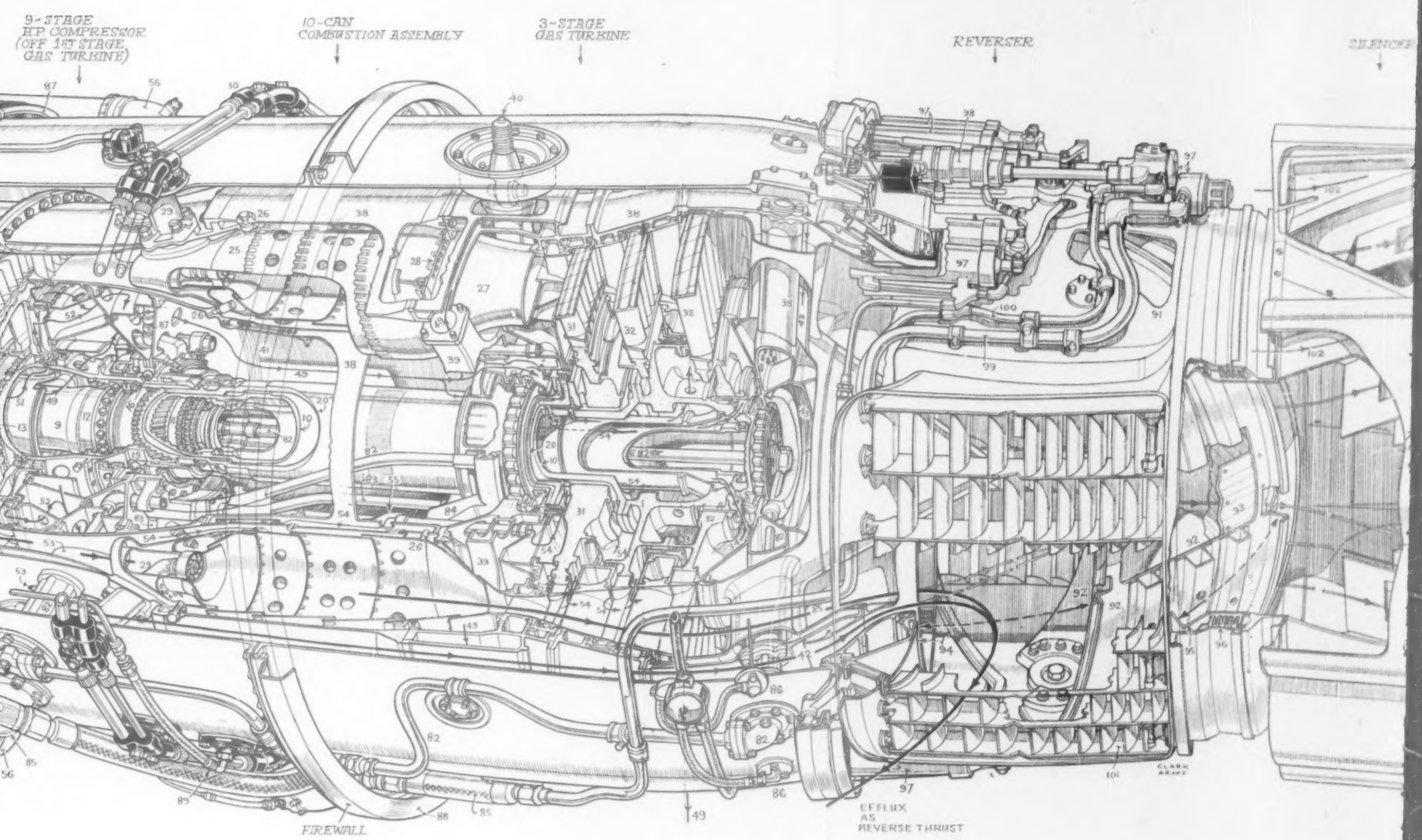


Rolls-Royce Conway RCo.12 Mk.

By-pass Turbojet of 17,500 lb. s.t.



lk.508

KEY

SEVEN-STAGE LP COMPRESSOR (driven by second- and third-stage turbine)

1. Shaft with engaging discs and pinned blades 2, front and rear bearings 3, and inner tube 4 sealed at front end.
5. Stator blades mounted in annular grooves in half-casings and held by check-plate 6 each side (all shrouded plus outlet guide vane 7).
8. Spline-coupling to intermediate shaft.
9. Intermediate shaft couples up to the second- and third-stage turbine shaft 10, at spline 11 where it is centred in HP compressor via thrust-bearing 12.

NINE-STAGE HP COMPRESSOR (driven by first-stage turbine)

13. Shaft with engaging discs and pinned blades 14, and running in front and back bearings 15 and 16.
17. Stator blades mounted in annular grooves and held by retaining bolts 18, in sections. (First three rows shrouded.)
19. Splined coupling to first-stage turbine shaft 20 which drives it.
21. Power take-off gear (at front end) drives external auxiliaries gearbox 22, through port bevels 23 and external gearbox through starboard bevels (not seen).
24. Power take-off gear (further forward) drives external tachometer via vertical bevel drive (not seen).

TEN-UNIT COMBUSTION ASSEMBLY

25. Combustion chambers supported (26) between intermediate (backbone) casings.
27. Nozzle with support-baffle 28, burner 29, starting and main fuel lines 30.

THREE-STAGE TURBINE

31. First-stage rotor bolted to shaft 20, drives HP compressor.
32. Second and third stages (bolted to each other 33, and shaft 10) drive LP compressor, all fir-tree rooted.

CASING

34. LP compressor outlet casing with engine mountings 35, and twin-annulus 36, 37 (HP compressor and by-pass).
38. Intermediate (backbone) casings with ten-arm spider support 39 (top arm carries engine rear mounting 40) turbine casing and rear-bearing support.
41. Inner air-casing and heat guard.

AIR SYSTEMS

42. By-pass (and tail-bearing cooling and seal-pressurizing 43).

Low Pressure

44. From fifth stage down into shaft along outside tube 4 to front bearing seals.
45. From fourth stage into casing 45, ducts 46, arms 47, branch to seals 48, along 49 up arms 39 and out of annulus at bottom (all mainly for seal pressurizing).
50. Some by-pass air at top of annulus 37 available for tapping for aircraft de-icing.

HP Intermediate (cooling last stage disc of compressor)

51. Third-stage HP tapping into shaft (but outside sleeve), up 52, 53 into by-pass stream.

HP (Turbine cooling)

54. Part of main HP delivery bled off at 55.

INTAKE ANTI-ICING AND OIL SYSTEMS

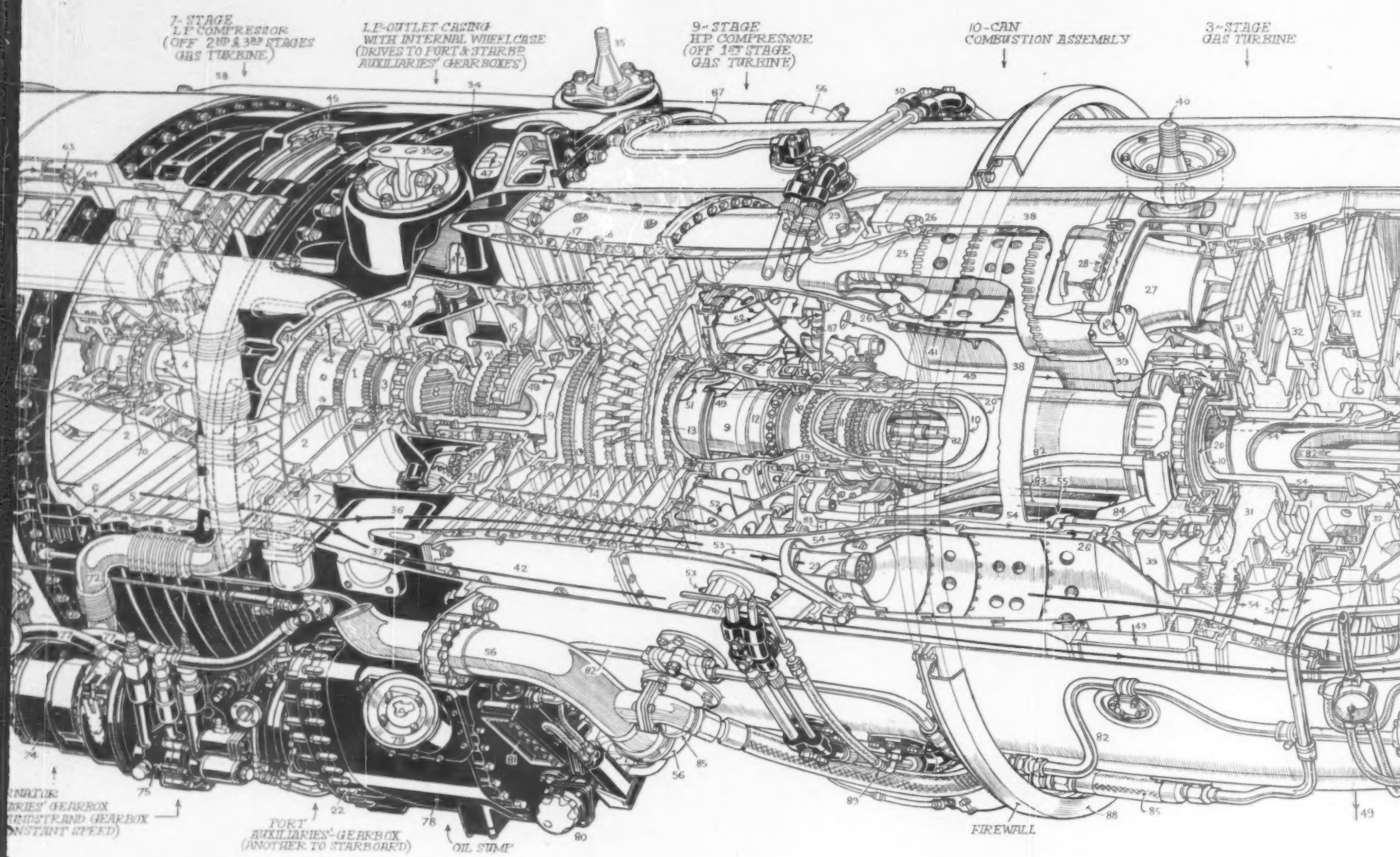
56. There are three tappings off HP compressor delivery (one not shown for aircraft pressurizing).
57 and 58. Feed (engine-intake anti-icing systems) from 56 into duct 59 down guide-vanes as 60 and back up, discharging into duct 61, out at 62 also down 63 up 64 out at 65.
66. Air down alternate tubes 66, into nose inner skin, out into outer skin 67, up other tubes 68 to duct 61.
69. One middle tube of first-stage stator carries oil down to bearing 3. Two other tubes drain back (oil jet 70 shown on NEXT blade to reveal it) and fed 71, from sump.
72. Hot air tapping and valve off 56/57 to fuel heater 73.
74. Alternator (off auxiliaries gearbox via Sundstrand drive 75 with its oil tank 76 and connections 77).
78. Main [illegible] level [illegible]
82. Oil to [illegible] at 83)
85. Air-pres[illegible]
86. Therm[illegible]
87. Thrust [illegible]
88. Firewa[illegible]
89. Igniter[illegible]
90. Oil sy[illegible]

REVERSER

91. Stresse[illegible] closed.
93. Noise [illegible]
94. Door [illegible]
95. Door [illegible]
97. Door [illegible]
98. Lock [illegible] revers[illegible]
99. Air s[illegible] contro[illegible]
100. Air d[illegible]
101. Detac[illegible]

SILENCER

102. Coolin[illegible]
104. Coolin[illegible]
105. Main [illegible]


7-STAGE LP COMPRESSOR (OFF 2ND & 3RD STAGES GAS TURBINE)
LP-OUTLET CASING WITH INTERNAL WHEELCASE (DRIVES TO PORT & STARBD AUXILIARIES' GEARBOXES)
9-STAGE HP COMPRESSOR (OFF 1ST STAGE GAS TURBINE)
10-CAN COMBUSTION ASSEMBLY
3-STAGE GAS TURBINE
PORT AUXILIARIES' GEARBOX (ANOTHER TO STARBOARD)
OIL SUMP
FIREWALL

Royce Conway RCo.12 Mk.508

Turbojet of 17,500 lb. s.t.

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31. First-stage rotor compressor.
32. Second and third and shaft 10) drive

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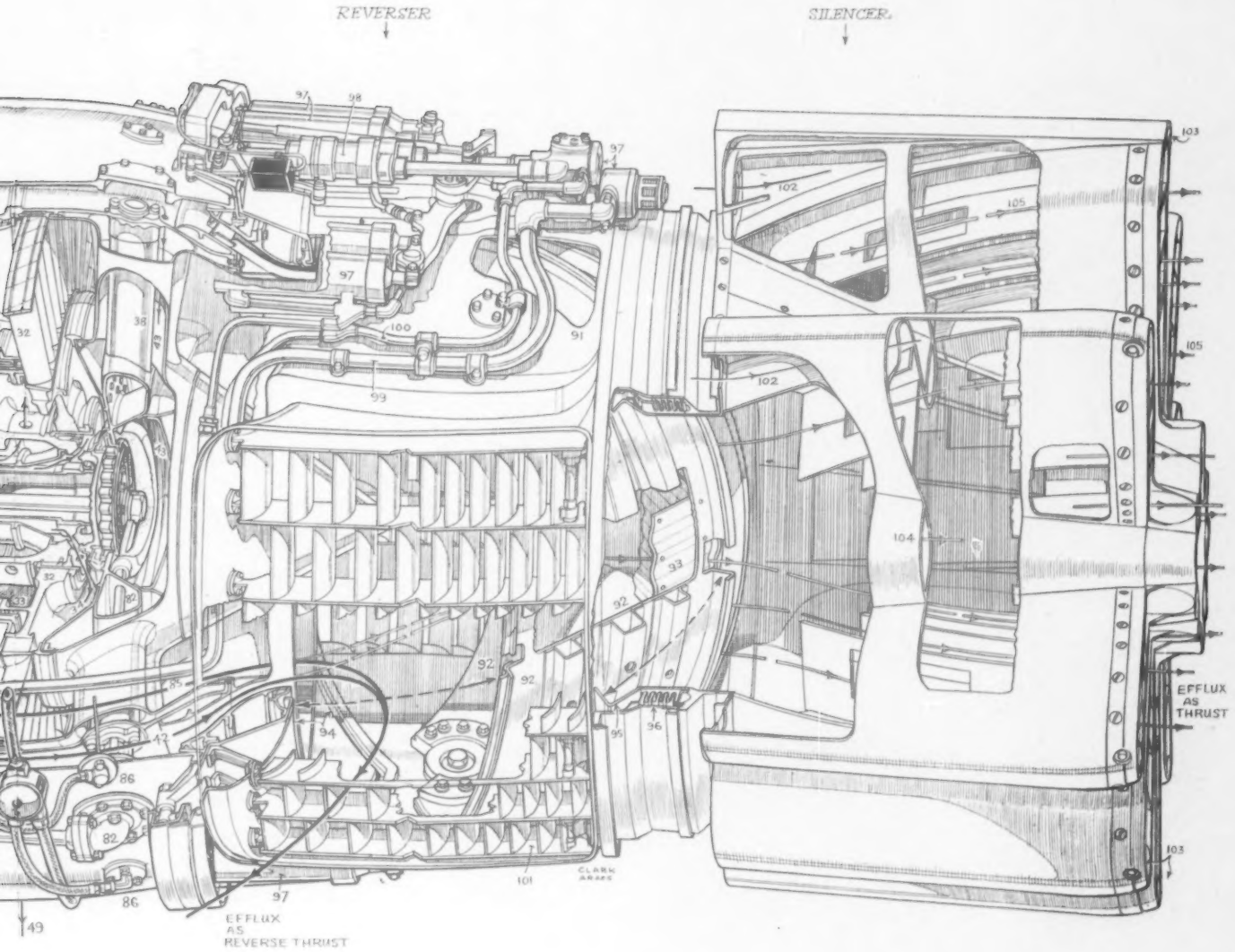
38. Intermediate (backb support 39 (top a 40) turbine casing
41. Inner air-casing an

AIR SYSTEMS

42. By-pass (and tail-be 43).

Low Pressure

44. From fifth stage d 4 to front bearing



Drawing by J. H. Clark, A.R.Ae.S.

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COMBUSTION ASSEMBLY

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GE TURBINE

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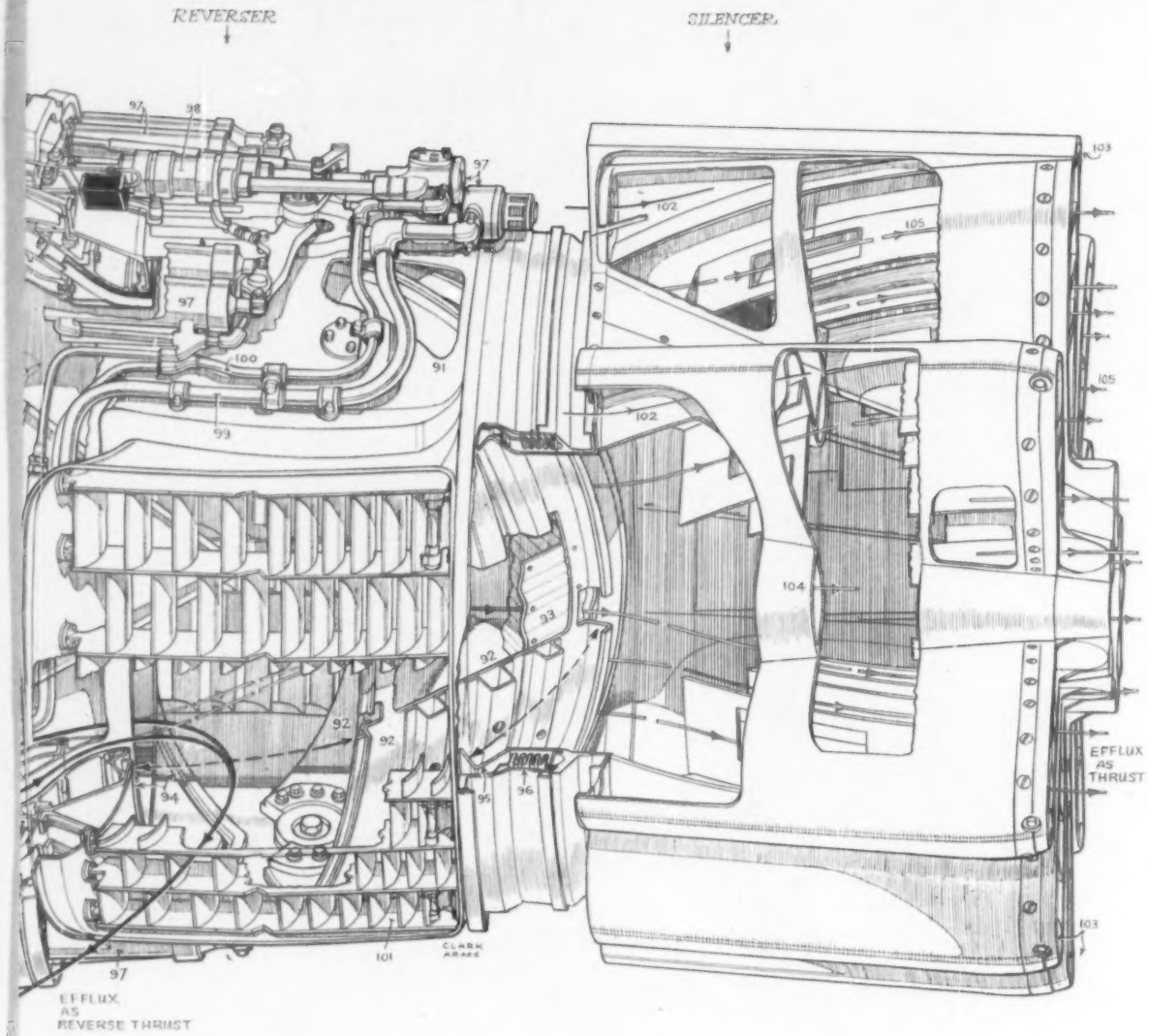
72. Hot air tapping and valve off 56/57 to fuel heater 73.
74. Alternator (off auxiliaries gearbox via Sundstrand drive 75 with its oil tank 76 and connections 77).
78. Main oil sump (open and pressure fillers 79, 80, level indicator 81).
82. Oil to thrust and tail bearings (one return shown at 83) out of sump 84.
85. Air-pressure regulating valve for HP air to thrust reverser and air supply pipe.
86. Thermocouples.
87. Thrust bearing air vent (on top).
88. Firewall.
89. Igniter plug (2 off).
90. Oil system pressure balance pipe.

REVERSER

91. Stressed casing and pair of doors (92) shown nearly closed.
93. Noise baffle plates.
94. Door front-seal.
95. Door rear-seal and spring-bellows (96).
97. Door operating jacks (in pairs to give sufficient force).
98. Lock ram undoes lock to allow door-closure into reverse thrust.
99. Air supply line (from 85), pressure-reducing and control valves.
100. Air distribution pipes (to upper and lower jacks).
101. Detachable cascade-vane assembly.

SILENCER

102. Cooling air and adjustable orifice 103.
104. Cooling air.
105. Main flows.



Drawing by J. H. Clark, A.R.Ae.S.

© Temple Press Limited, 1960

) between inter-

29, starting and

20, drives HP

each other 33.
ll fir-tree rooted.

ngine mountings
compressor and

ten-arm spider
rear mounting
support.

seal-pressurizing

ng outside tube

45. From fourth stage into casing 45, ducts 46, arms 47, branch to seals 48, along 49 up arms 39 and out of annulus at bottom (all mainly for seal pressurizing).
50. Some by-pass air at top of annulus 37 available for tapping for aircraft de-icing.

HP Intermediate (cooling last stage disc of compressor)

51. Third-stage HP tapping into shaft (but outside sleeve), up 52, 53 into by-pass stream.

HP (Turbine cooling)

54. Part of main HP delivery bled off at 55.

INTAKE ANTI-ICING AND OIL SYSTEMS

56. There are three tappings off HP compressor delivery (one not shown for aircraft pressurizing).
57 and 58. Feed (engine-intake anti-icing systems) from 56 into duct 59 down guide-vanes as 60 and back up, discharging into duct 61, out at 62 also down 63 up 64 out at 65.
66. Air down alternate tubes 66, into nose inner skin, out into outer skin 67, up other tubes 68 to duct 61.
69. One middle tube of first-stage stator carries oil down to bearing 3. Two other tubes drain back (oil jet 70 shown on NEXT blade to reveal it) and fed 71, from sump.
72. Hot air tapping and valve off 56/57 to fuel heater 73.
74. Alternator (off auxiliaries gearbox via Sundstrand drive 75 with its oil tank 76 and connections 77).
78. Main oil sump (open and pressure fillers 79, 80, level indicator 81).
82. Oil to thrust and tail bearings (one return shown at 83) out of sump 84.
85. Air-pressure regulating valve for HP air to thrust reverser and air supply pipe.
86. Thermocouples.
87. Thrust bearing air vent (on top).
88. Firewall.
89. Igniter plug (2 off).
90. Oil system pressure balance pipe.

REVERSER

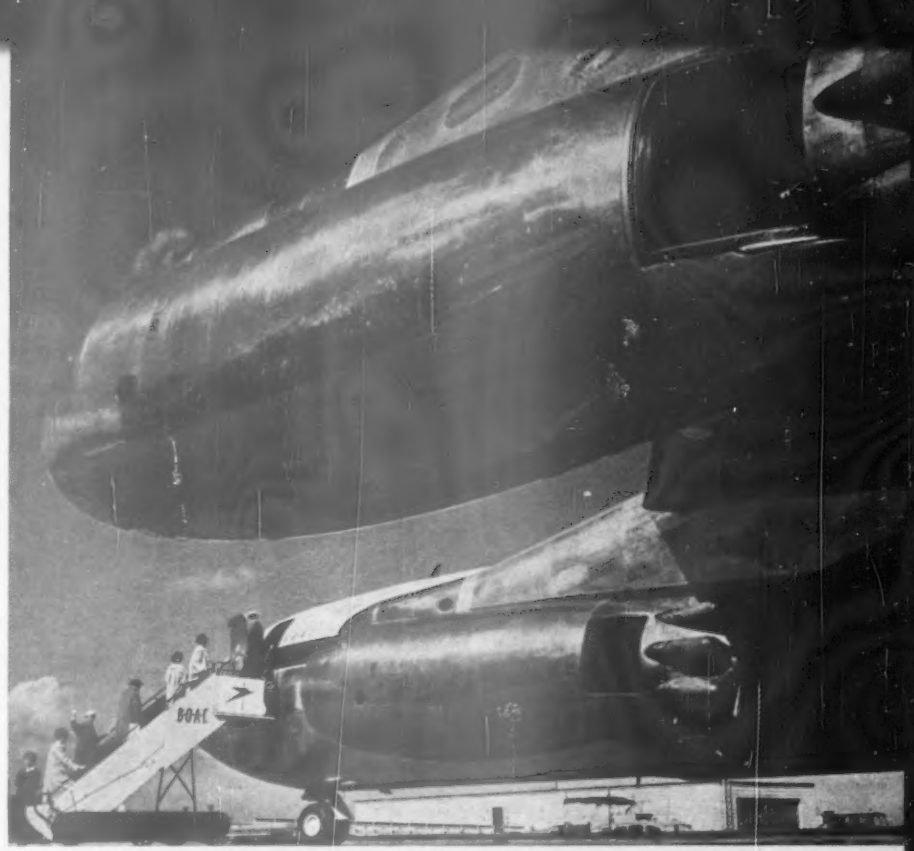
91. Stressed casing and pair of doors (92) shown nearly closed.
93. Noise baffle plates.
94. Door front-seal.
95. Door rear-seal and spring-bellows (96).
97. Door operating jacks (in pairs to give sufficient force).
98. Lock ram undoes lock to allow door-closure into reverse thrust.
99. Air supply line (from 85), pressure-reducing and control valves.
100. Air distribution pipes (to upper and lower jacks).
101. Detachable cascade-vane assembly.

SILENCER

102. Cooling air and adjustable orifice 103.
104. Cooling air.
105. Main flows.

Rolls-Royce Conway

First of the commercial by-pass engines



CONWAY BOEING.—Differences between the reverser cascades on the inner and outer engine pods of this B.O.A.C. Boeing 707 prevent adverse flow interaction between the pods when reverse thrust is selected.

TEN years of development and ten million hours of airline experience with Rolls-Royce gas turbines lie behind the Conway as it enters service with B.O.A.C.'s Boeing 707s. This by-pass engine has a secure niche in history. As the first commercial ducted-fan engine it has been a major influence in causing the World's main aero-engine manufacturers to develop a range of turbofans.

Although the various companies have their own names for this type of engine, there is no fundamental difference between the by-pass, the ducted fan and the turbofan engine; all three rely on compressor stages to provide a propulsive airflow which by-passes the engine's combustion system. The hurried development of such engines, in some cases derived directly from existing turbojets, can be attributed to the commercial success of the Conway.

There has been much technical argument about the pros and cons of the by-pass engine. It is impossible to consider this in detail here, but the fundamental thinking behind this type of engine can be given briefly.

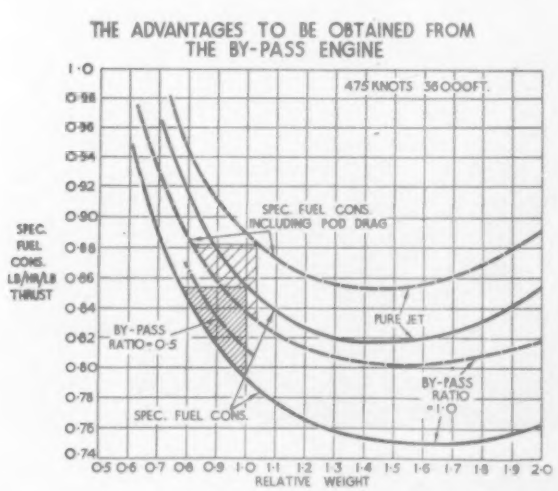
By-pass Advantages

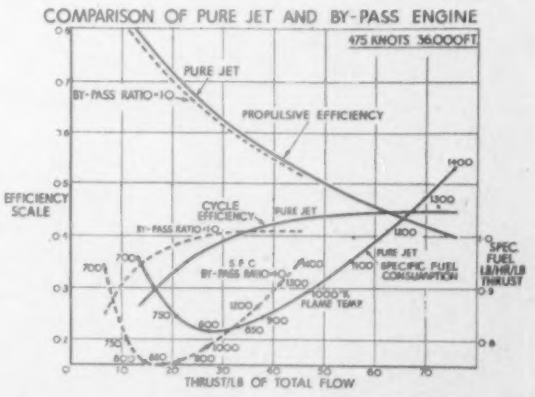
Basically the Conway by-pass engine has been designed for long-range transports operating at high subsonic speeds. The addition of a by-pass to the two-spool jet engine has been made to improve its propulsive efficiency. This is done by producing a lower jet velocity than that of the simple jet, but without compromising cycle efficiency. The pure jet can also be made to operate at a low flame temperature to give a lower jet velocity similar to that of the by-pass engine, but if this is done its cycle efficiency is reduced at economical cruise conditions.

A design study of the performance and weight of directly comparable by-pass and pure jet engines has been made by Rolls-Royce. It shows that the by-pass engine has a better fuel consumption at a given flame temperature, or a lower weight for a given fuel consumption.

Accompanying graphs give the results of this study. Based on these, the company has claimed for several years that a Conway-engined transport would have a 5% better range than if it had pure jet engines of the same pressure ratio and designed with the same skill.

This Rolls-Royce faith in the Conway appears to have been justified. Boeing figures show that the still-air range of the Conway-engined 707-420 with a 34,965-lb. payload and 21,200 U.S. gallons of fuel, with reserves, is 5,125 miles; the comparable range of the Boeing 707-320, which has





BY-PASS *v.* PURE JET.—These graphs from a 1957 paper by Mr. A. A. Lombard of Rolls-Royce are based on studies by the company; they show the advantages of the by-pass over the pure jet engine for transports operating at high subsonic speeds.

Pratt & Whitney JT4 engines, is 4,730 miles. On this basis the Conway-engined aircraft has an 8.4% better range.

Conway History

The first Rolls-Royce proposal for a by-pass engine dates back to late 1946 when Dr. A. A. Griffith, the company's chief scientist, suggested an engine using components from the Avon and the Tweed. A more advanced version developing just under 5,000 lb. thrust was proposed in April, 1947.

Other projects were put forward in October, 1947; April, 1948; and October, 1948, when the RB.80 was proposed. This 9,250-lb. thrust by-pass engine was submitted to the Ministry of Supply as the powerplant for the Vickers Pathfinder, the Mk. 2 version of the Valiant bomber, which was later cancelled.

Various stages followed before the design of the Conway RCo.2 began in January, 1950. Only one engine of this type was built. Of two-spool layout, it had four-stage L.P. and eight-stage H.P. compressors driven by two-stage H.P. and two-stage L.P. turbines. From the start all Conways had air-cooled first-stage turbine blades.

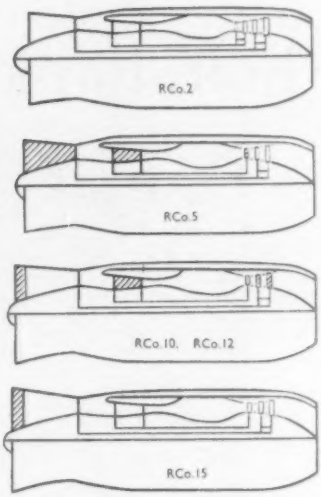
This engine first ran in July, 1952, and, according to Mr. A. A. Lombard, Rolls-Royce director of engineering, aero-engine division, "It must have known that it was going to be superseded, as it ran perfectly for the whole of its 133 hours life." In January, 1953, it produced a thrust of 10,000 lb.

At this time the Vickers V.1000 military jet transport was being considered and the design of a more powerful Conway, the RCo.5, for this aircraft was begun in January, 1952. This engine had six-stage L.P. and nine-stage H.P. compressors driven by single-stage H.P. and two-stage L.P. turbines.

Thirteen of these engines were built; the first ran in July, 1953, and passed an official type test at a 13,000-lb. dry rating in August, 1955. The engine did not go into production because a greater thrust was in demand for the V.1000. It was, however, flight-tested in an Avro Ashton and in a Vulcan, completing 980 hr. in flight.

The next version of the Conway, the RCo.8, was intended for the Handley Page Victor bomber. It had the same components as the RCo.5, but a more efficient air-cooling system, and was rated at 14,500 lb. thrust. Its first test runs were in January, 1956, but the engine did not go into production, and a more advanced Conway, the RCo.11 of 17,250-lb. thrust was later produced for the Victor 2.

The first Conway designed specifically as a civil powerplant was the RCo.10. Trans-Canada Air Lines was one of the earliest operators to show an interest in the Conway and as a result of this Rolls-Royce put a considerable effort into persuading Boeings and Douglas that there would be a worthwhile market for Conway-engined 707s and DC-8s. This was done successfully and in May, 1956, the first order for Conway-engined transports was announced by T.C.A.; this company chose DC-8s.



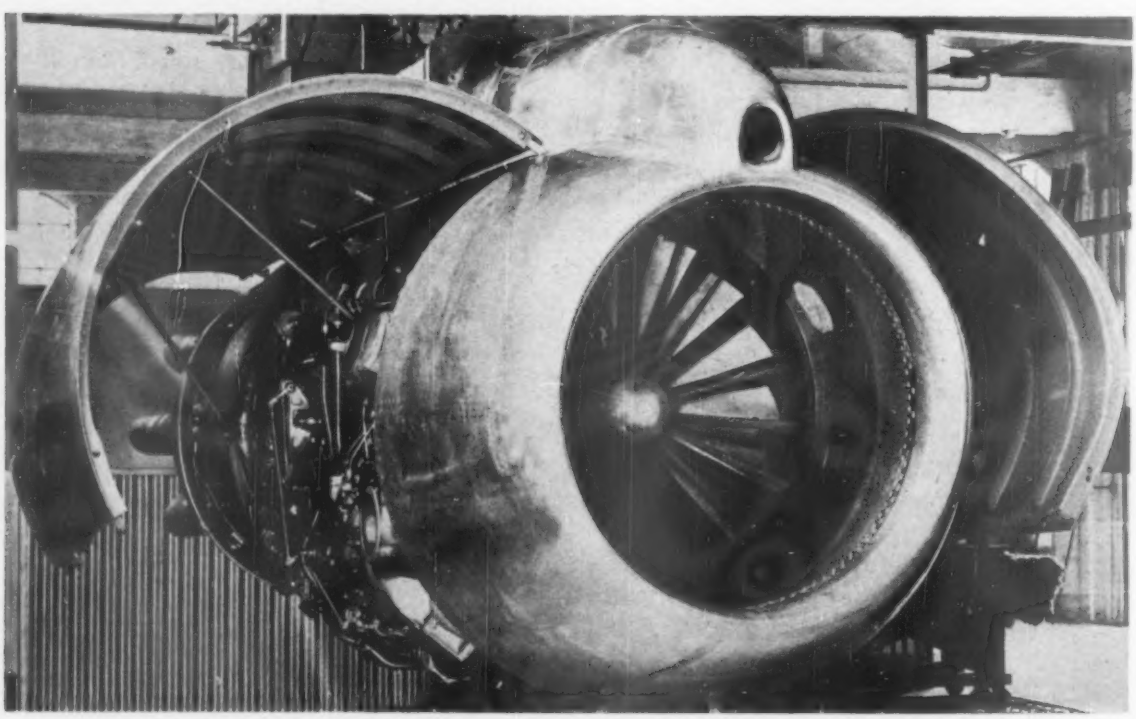
CONWAY DEVELOPMENT.—The main stages in Conway evolution are shown here diagrammatically; shaded portions indicate where an engine differs from its predecessor. Differences between the engines are described in the text.

This breakthrough was followed by orders for Conway-engined Boeing 707s from B.O.A.C., Lufthansa, Varig and Air India and Conway DC-8s for Alitalia and Canadian Pacific Air Lines.

Following this sales triumph the development of the RCo.10 was given top priority by Rolls-Royce and an intensive development programme was begun in August, 1956, for the design and production of this engine, which differs extensively from its predecessors. As a result RCo.10s cleared for certification flying were delivered to Douglas and Boeings little more than two years later in September, 1958.

A comparable development programme in the past would have taken four to five years. Despite the vast effort and

(*Continued on page 83*)



HIGH-POWERED POD.—For the Boeing 707 Rolls-Royce supplies complete Conway powerplant pods. Large doors give access to powerplant accessories.

THE BOEING 720

offers airlines greatest profit potential of any jetliner in its class

The versatile new Boeing 720 rolled out of Boeing's Transport Division plant late in October, and is now undergoing tests. Forty-six 720s have already been ordered by leading airlines.

Designed to operate efficiently and profitably over short-to-medium range routes, the 720 will cruise at speeds in excess of 600 miles an hour. It will bring airlines great profit potential, for it has the lowest seat-mile cost of any jetliner in its class. An extensive prototype flight-test programme has proved out the 720s ability to carry a greater payload from smaller fields than any jetliner in its class. The 720 has a seating capacity of 80 to 150 passengers, providing unusual flexibility in seating arrangements.

The Boeing 720 will also bring airlines the advantages of extremely high initial utilization and unprecedented passenger appeal—as demonstrated by the record of Boeing jets already in service.

Since going into service, Boeing jets have flown more than 45,000,000 miles in scheduled operations. Load factors have averaged more than 90%, making Boeing jets the most popular airliners in aviation history.

These airlines have ordered 197 Boeing 707s or shorter-range 720s:

AER-LINGUS · AIR FRANCE
AIR-INDIA · AMERICAN · B.O.A.C.
BRANIFF · CONTINENTAL
CUBANA · LUFTHANSA
PAN AMERICAN · QANTAS · SABENA
SOUTH AFRICAN · TWA · UNITED
VARIG · *also* MATS

BOEING 720

She's all yours!

'This is it! Solo for the first time. Start with cockpit checks—instruments, oil pressure, take-off trim. Good. Brakes off . . . a quick look round . . . full throttle.'

'Keep her straight. Ah!—not so bumpy, nose wheel is off the ground. Faster . . . faster . . . gently back with the stick . . . up and away in a steady climb.'

Today's pilot starts on jets!

You could be in a Jet Provost learning to fly within a few months of getting your R.A.F. uniform. Quick progress, and so it goes on. Once you are qualified, the world is your parish. Flying is your profession, but you will add to it experience and increasing authority. A career in the R.A.F. blends adventure with high responsibility.

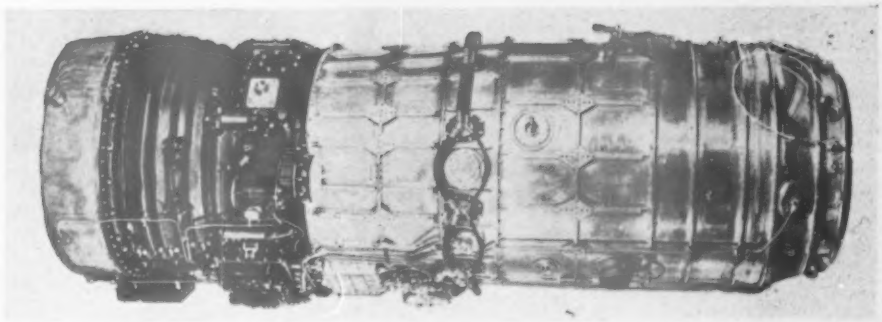
A full life...with the Royal Air Force

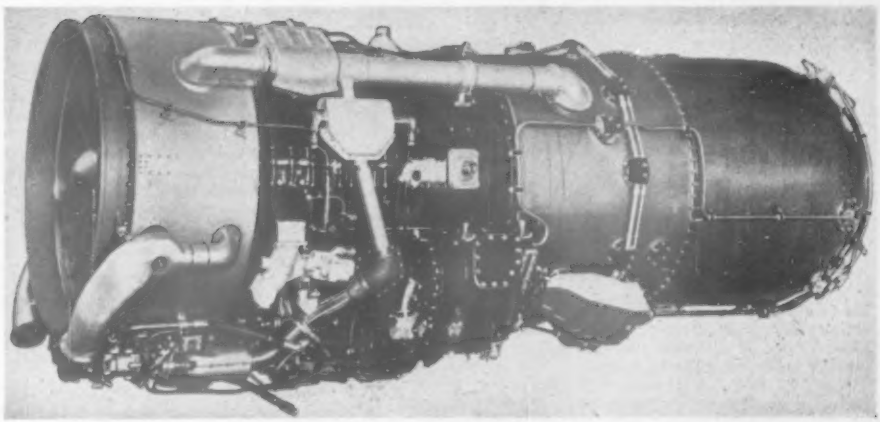
Could you make the grade as an R.A.F. aircrew officer? For details of how to apply, of pay, conditions and allowances, write to the Air Ministry (M.9) (AP54), Adastral House, London, W.C.1. (Applicants must be between 17½ and their 26th birthday and have gained a good G.C.E. or equivalent.)

Three types of commission: (1) Permanent, leading to retired pay. (2) 12 years, with the option of leaving after 8 years, and the chance of gaining a permanent commission. (3) 5 years, also with the chance of gaining a permanent commission.

'Steady though; we've still got to land . . . down undercarriage . . . down flaps. . . . This is living! This is why I wanted to join the R.A.F.'

'Not bad . . . not bad at all. A little wide on the approach, but a smooth enough touch-down. And my best take-off yet. Hope my instructor was watching.'





PAST AND PRESENT.—The first Conway to run, the RCo.2 (above) is compared with one of the latest, the RCo.11, which powers the Handley Page Victor 2 bomber. The RCo.2 gave 10,000 lb. thrust; the RCo.11 delivers 17,250 lb.

resources involved, the total cost was less than if a more leisurely programme had been followed.

The RCo.10 differs from the RCo.8 in having an additional, or zero, stage on the L.P. compressor, an H.P. compressor of 10% greater capacity and L.P. turbine blades of greater diameter. In addition it has engine accessories designed both for civil operation and for a podded installation. Also developed for this engine were its thrust reverser and silencer; for the Boeing 707 installation Rolls-Royce supply a complete powerplant pod.

As a civil engine the RCo.10 had to be designed for a long life and to meet the stringent safety requirements laid down by the A.R.B.; these are more exacting than the requirements for military engines. It was planned to offer an initial overhaul life of about 800 hr. and component lives of 10,000 hr. were aimed at.

As a result, special long-term running tests were made on the engine and its accessories. These included three 1,000-hr. tests, one with a complete Boeing 707 podded installation. Sixteen 150-hour tests to the U.S./U.K. type-test schedule have been made at thrusts over 16,500 lb.

Among many stringent safety tests were those made to prove that the engine would safely swallow 3-in.-diameter hailstones entering its intake at 420 knots. Compressor blades were bent in this test, but the engine continued to run satisfactorily. Overspeed and blade-containment tests were made to ensure that the blades would not leave the engine pod if there were a failure in flight.

The next version of the Conway was the RCo.12 which is the RCo.10 up-rated to provide a guaranteed minimum take-off thrust of 17,500 lb. compared with 16,500 lb. for the RCo.10. Original plans called for the Conway to enter airline service at the RCo.10 power and to be up-rated after 12-18 months of operating experience. But development of the engine has gone very well and the RCo.10 was recently up-rated ahead of schedule so that Conways for the Boeing 707 and DC-8 will go into service at the RCo.12 rating.

Guaranteed minimum take-off thrusts for Rolls-Royce engines have only been quoted since their choice for U.S. jet transports. In the past, power ratings were quoted for an average engine, which would deliver these powers within limits of ±2%. But it is U.S. practice to base take-off performance calculations on a guaranteed minimum take-off thrust. For the RCo.12 this is 17,500 lb.; in fact, an average engine delivers 18,000 lb. of thrust and this would have been its rating on the old basis.

The next stage in the development of the Conway is the RCo.15 which will be available from late 1960. It differs from the RCo.12 in having a larger-diameter zero-stage on its L.P. compressor and has other detailed improvements to reduce leakage losses. Its mass-flow is increased by 5% and its guaranteed minimum take-off thrust has gone up to 18,500 lb.; in addition, the cruise s.f.c. is improved by 2½-3½%. Operators will be able to convert their RCo.12s to RCo.15s during overhaul.

Most of the Conways currently on order are RCo.12s. They will be installed in 24 Boeing 707-420s—15 for B.O.A.C., four for Lufthansa, two for Varig and three for Air India; and 12 Douglas DC-8s—six for Trans-Canada Air Lines and six for Alitalia. Canadian Pacific Air Lines will have four DC-8s with RCo.15s and B.O.A.C. has ordered 35 Vickers VC-10s with the latest Conway, the RCo.42.

COMMERCIAL CONWAYS

	RCo.12	RCo.15	RCo.42
Guaranteed minimum static thrust for take-off, I.S.A. conditions, at sea level, lb.	17,500	18,500	20,250
Cruise at 35,000 ft., 475 kt., I.S.A. conditions s.f.c. at 3,950 lb. thrust, lb./lb./hr.	0.874	0.842	0.785
s.f.c. at 3,500 lb. thrust, lb./lb./hr.	0.870	0.838	0.787
Maximum dry weight, lb.	4,504	4,544	5,001
Mass flow, lb./sec.	282	295	363

This version of the engine differs extensively from the RCo.15. It has been designed from the start for podded installation on the VC-10 and thus its diameter has not been restricted by the buried installations for which the early Conways were intended. It has a by-pass ratio of 0.6 compared with 0.3 for the RCo.15.

Increased thrust and improved s.f.c. are provided by a larger capacity L.P. compressor with an L.P. turbine of increased diameter to match it. The H.P. compressor and turbine and the combustion system are the same as on the standard RCo.12 and RCo.15 engines. These engines could be modified to RCo.42 standard, but it would be a very extensive conversion.

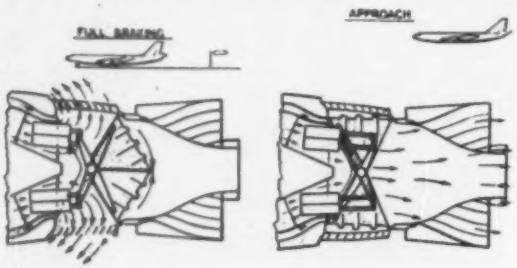
The RCo.42 offers a guaranteed minimum take-off thrust of 20,250 lb. and a cruise s.f.c. of 0.785 lb./lb./hr. at 475 kt. at 35,000 ft. in I.S.A. condition; this is more than 10% below the RCo.12 cruise consumption. This engine has been developed for the VC-10, but would also be suitable for a very long-range

version of the Boeing 707. The U.S. company is said to show great interest in it.

The RCo.42 can be regarded as a second-generation by-pass, as can the RB.141 and the RB.163. This Rolls-Royce family of by-pass engines was described in THE AEROPLANE AND ASTRONAUTICS for November 20, 1959.

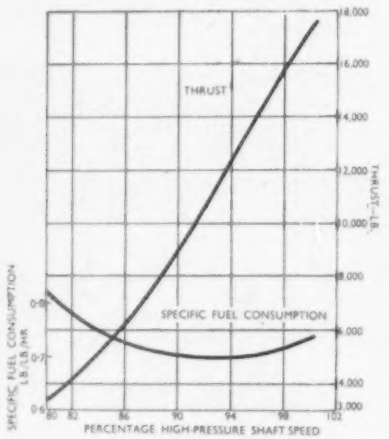
RCo.12 Features

A two-shaft engine, the RCo.12 has seven-stage L.P. and nine-stage H.P. compressors driven by single-stage H.P. and two-stage L.P. turbines. Of the total mass flow through the engine, 23% is by-passed downstream of the L.P. compressor and passes through an annular duct around the engine, joining the hot flow downstream of the turbines.

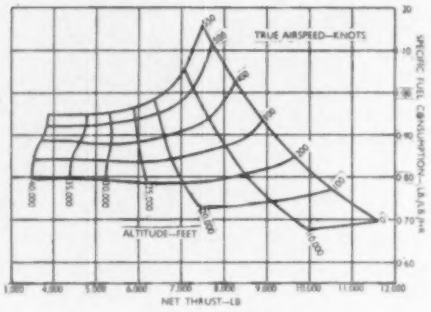


THRUST REVERSER.—These diagrams show how the Conway thrust reverser deflects the jet efflux forward; maximum reverse thrust is about 50% of the normal forward thrust.

This flow is metered only by the exhaust orifice. The flow is decelerated on entering the by-pass duct, which is unfaired internally, and accelerated only on passing through the outlet to mix with the hot exhaust flow.



STATIC PERFORMANCE.—Static thrust and specific consumption of the Conway 508 for the Boeing 707 is given here. The performance is for an engine with thrust reverser and silencer in sea-level I.S.A. conditions; no intake losses are allowed for.



CRUISE PERFORMANCE.—This graph shows Conway 508 performance in I.S.A. conditions at the recommended cruise power which is 93% H.P. compressor r.p.m. The Conway 508 is the RCo.12 as installed in the Boeing 707.

Pin-fixed compressor blades are used to minimize resonance difficulties. All the L.P. compressor stages except the last are of aluminium alloy. This last stage and seven of the H.P. compressor stages have titanium blades. Steel blades are used for the last two H.P. stages.

The by-pass duct casing is made of butt-welded titanium alloy and is locally reinforced where there are cut-outs. Extensive fatigue tests have been made on this duct, which carries the full thrust-reverser load of 24,000 lb. in addition to pressure loads.

The combustion system is of cannular layout, with 10 Nimonic flame tubes. High-energy ignition plugs protrude into two of the tubes, all of which are interconnected to allow flame spread when starting.

Shrouded Nimonic 95A blades with internal ducts for air cooling are used for the H.P. turbine. Details of the air cooling system are still secret; Rolls-Royce hold an unrivalled position in this field. It is significant that even the first Conway designed 10 years ago incorporated air-cooled blading and the company has extensive experience of the technique on this and other engines.

The two L.P. turbine stages are also shrouded, but the blades are not cooled. As with the H.P. stage, fir-tree root attachments are used.

The thrust-reverser unit is attached to the end of the by-pass unit and forms the jet pipe; the multi-lobe silencer is attached to its rear ends. The reverser has two diametrically opposed outlets in the walls with cascade vanes to deflect the gas discharge forward.

Normally these outlets are closed by eyelid shutters. The shutters are operated by pneumatic rams which move them into the main jet efflux when reverse thrust is selected. Maximum reverse thrust is about 50% of the normal forward thrust.

Into Service

More than 19,000 ground-running hours and 6,000 flight hours will have been built up by the Conway before it enters service. By late 1963 well over one million engine hours should have been completed in jet airliners and the overhaul life is expected to have reached 2,000 hr.

There seems little doubt that the Conway will be one of the most important airline engines of the 1960s. The RCo.42, which will be available at the end of 1961, has no comparable rival at present and this and earlier Conways will probably remain in service well into the 1970s.—J.R.C.

CONWAY SUPPLIERS

The following list of suppliers of materials and equipment for the Conway has been provided by Rolls-Royce, Ltd.

Components.—Aircraft Sheet Metal Engineers, Ltd.; Associated Electrical Industries, Ltd.; Automotive Products Co., Ltd.; Avica Equipment, Ltd.; J. R. Bramah and Co., Ltd.; Clifford Products, Ltd.; Delaney Gallay, Ltd.; Dunlop Rubber Co., Ltd.; Fischer Bearings Co., Ltd.; C. W. Fletcher and Sons, Ltd., Frank Ford, Halifax.

Graviner Manufacturing Co., Ltd.; Hoffman Manufacturing Co., Ltd.; Richard Klinger, Ltd.; Lodge Plugs, Ltd.; Joseph Lucas (Gas Turbine Equipment), Ltd.; Marston Excelsior, Ltd.; F. G. Miles, Ltd.; Moorgreen Metal Industries, Ltd.; Morris Motors, Ltd.; Palmer Aero Products, Ltd.; Park Ward and Co., Ltd.; W. H. Paul, Ltd.; Precision Rubbers, Ltd.

Rist's Wires and Cables, Ltd.; Rotax, Ltd.; Smiths Aircraft Instruments, Ltd.; Herman Smith, Ltd.; Tecalemit, Ltd.; Teddington Aircraft Controls, Ltd.; Mark Tyzack and Sons, Ltd.; Ultra Electric, Ltd.; V.P. Sheet Metal, Ltd.; Wellworthy, Ltd.; Wilmot Breeden, Ltd.

Materials.—Accles and Pollock, Ltd.; Aluminium Corporation, Ltd.; James Booth and Co., Ltd.; C. G. Carlisle and Co., Ltd.; Dunford and Elliott (Sheffield), Ltd.; Firth Brown Steels, Ltd.; Firth-Vickers Stainless Steels, Ltd.; Samuel Fox and Co., Ltd.; J. J. Habershon and Sons, Ltd.; High Duty Alloys, Ltd.; Imperial Chemical Industries, Ltd.; Park Gate Iron and Steel Co., Ltd.; Stainless Steel Wire Co., Ltd.; Henry Wiggin and Co., Ltd.; G. L. Willan, Ltd.; Yorkshire Engineering Supplies, Ltd.

Forgings.—Bretts Stamping Co., Ltd.; Brown Bayley Steels, Ltd.; Deritend Stamping Co., Ltd.; Daniel Doncaster and Sons, Ltd.; Dudley Drop Forging Co., Ltd.; English Steel Forge and Engineering Corp., Ltd.; Eva Brothers, Ltd.; Firth Brown Steels, Ltd.; Firth-Derihon Stampings, Ltd.; High Duty Alloys, Ltd.; N. Hingley and Sons, Ltd.; Hughes-Johnson Stampings, Ltd.

Leslie and Co. (Birmingham), Ltd.; Platts Forgings, Ltd.; Reynolds Tube Co., Ltd.; A. Robinson and Sons, Ltd.; Southern Forge, Ltd.; A. W. Sutton and Co., Ltd.; Tubes, Ltd.; Wednesbury Stamping and Manufacturing Co., Ltd.; H. W. Wyld and Co., Ltd.

Personal Flying

IN South Africa, the Union Government intends to resume its flying subsidy for the training of pilots. The payment of subsidies to flying clubs on the basis of the number of pilots they train ended in April. There are 2,000 private pilots in the Union. The scheme worked like this:—

To train a private pilot costs roughly £200, for the 40 statutory flying hours at £5 an hour. For every pilot who qualified, the Government gave £40 to the pilot and £40 to the club which trained him. The Aircraft Owners' and Pilots' Association (membership 1,400) pointed out to the Department of Transport the importance of having a pool of qualified private pilots in South Africa. As an example they cited Tanganyika pilots who, when telephone wires were cut recently, kept communications in being.

Recently the Aircraft Owners' and Pilots' Association sent a circular to the 49 flying clubs in the Union and South West Africa asking which clubs would cease to exist if the Government subsidy was withdrawn. Only two clubs said that they could carry on. These two do the bulk of their business through the sales and maintenance of aircraft and do not rely on the training of pilots.

The official reply, signed by the Secretary for Transport, to the question of resuming the subsidy, reads: "Proposals for a further flying subsidy have been prepared and are receiving final consideration. As these proposals still have to be submitted to the Treasury, it is not possible to give details at this stage."

Pilots hope that this reply means that if and when the subsidy is resumed, payments will be back-dated to cover the expenses of training students since April. It is pointed out that the resumption of the subsidy may mean the survival of many flying clubs in the Western Cape which have been facing the future with fear.

• • •

It is pleasant to be able to record some progress with light aeroplane development in India, where the Hindustan Aircraft company is producing some original designs at Bangalore. After the introduction of the HT-2 trainer, which was the first production design of HAL, the company followed with the Pushpak ultra-light two-seater. Powered by a 90 b.h.p. Continental flat-four engine, this high-wing monoplane made its initial flight on September 28, 1958, and production aircraft are to have the HAL-designed PE-90 engine.

The Pushpak is intended principally as a low-cost type for clubs and private owners, and a Mk. 2 variant is being developed as a four-seater. Hindustan Aircraft have since produced another four-seater, to a similar configuration, but scaled up in size and with a more powerful engine.

This newer type, the Krishak, was developed primarily to agricultural aviation requirements, and the prototype has a 190 b.h.p. engine. The Krishak is of classic fabric-covered mixed construction, with a capacity for four persons and 120 lb. of baggage when not equipped for spraying or dusting. India has a large requirement for agricultural aircraft, which has not been met hitherto because of foreign currency difficulties.

Alternative rôles for the Krishak include air ambulance duties, for one stretcher patient, light liaison or A.O.P. operations. It will eventually be powered by an indigenously developed powerplant, as in the case of the Pushpak.

• • •

Although the 1959 Model Bonanza was the K35, its 'Sixties successor has been labelled the M35, to avoid confusion with the military "L" designations. Since its introduction in 1947, the Beech Bonanza has been one of the most successful of all light aeroplanes, and more than 6,000 examples have now been sold. It has established several class records during its long career, and in its latest form it is still claimed to be the fastest all-metal single-engine business aircraft.

The M35 retains the 250 b.h.p. Continental I0-470-C fuel injection engine of its predecessor, but incorporates an aerodynamic refinement in the squared and cambered shape of Hoerner-type wing-tip extensions which were first featured on the veteran Twin Beech Model 18. The remarkable aerodynamics of the Bonanza are thus still further improved, and the maximum cruising speed trues out at the 200 m.p.h. mark. The interior has also been restyled, and new paint schemes have been made available.

BLUNT BONANZA.—The 1960 Model M35 Bonanza has squared and cambered Hoerner-type wing-tips, plus several other refinements. More than 6,000 Bonanzas have now been sold.

The gross weight remains 2,950 lb., with a maximum useful load of 1,118 lb., and the cruising range, at more than 20 miles per U.S. gallon, reaches 1,245 miles.

• • •

In the first nine months of 1959, nine U.S. light aircraft manufacturers delivered more than 5,600 machines, compared with 4,725 for the corresponding period during the previous year. Total finance involved was equivalent to £35 million for the 1959 period, and about £27 million for the previous nine months.

The final figure for 1959 deliveries was expected to exceed 7,000 aircraft. Individual companies for the nine-monthly span contributed thus: Aero Design, 111 Commanders; Beech, 668 aircraft; Call Air, 44; Cessna, 2,480; Champion, 207; Colonial. 17 Skimmers; Helio, 12; Mooney, 160; and Piper, 1,866. Cessna therefore had a clear lead in deliveries and in income. Beech followed in financial volume, with Piper a close third.

The rights and assets for the C-2 Skimmer amphibian have been acquired from Colonial Aircraft Corp. by the Lake Aircraft Corp. The single-engine four-seat Skimmer will continue to be built at Sanford, Me., firm orders having been placed for 15 more amphibians.

• • •

These American figures may well inspire awe in this country. After all, the annual production figure of 7,000 light aeroplanes is probably more than the British industry has produced for civil use during its entire existence. But compared with the motor industry, even American light aircraft construction has barely scratched the surface.

As the leading World company, so far as quantity is concerned, Piper recently sold its 50,000th light aircraft. This remarkable figure, representing nearly 30 years of intensive sales effort, corresponds to 2½ days' normal production by the U.S. automobile industry.

How many civil light aeroplanes have been produced in the U.K. since the end of World War II? A generous estimate might be 800; the figure is certainly not more than 1,000. Compare this with the output of the British motor industry, which during 1959 produced approximately 1,160,000 private cars, in addition to a large number of commercial vehicles. Each working day, in other words, saw the appearance of 3,000 or so new cars. The vital position which the motor industry occupies in our export effort clearly contains many lessons for our contracting aircraft manufacturing organization.

• • •

To stimulate sales of the two-seat Jodel D.117, for which they are the British agents, Rollasons of Croydon are offering free flying tuition to P.P.L. standard to all purchasers. With the increased interest in executive flying in this country, the suitability of the Jodel for this task for the smaller companies is being stressed by Rollasons.

The offer of instruction comes into force on the completion of the aircraft purchase, and can be taken at any airfield offering flying instruction in the U.K. At current rates, a P.P.L.

course is worth something like £120 or more; the initial purchase price of the S.A.N. Jodel is £2,600, which includes an 11-channel VHF radio, and a starter.

• • •

Shackleton's sales week-end—the "Farnborough" of light aeroplanes—is being held once again this year at Kidlington, between May 6-8. The company has announced that for those interested in new private and executive aeroplanes, there will be a wide selection of Continental models on view, in addition to the well-known American light aircraft.

• • •

A new hazard has emerged, albeit temporarily, for personal flyers in the United States. Since November 23, Strategic Air Command has been undertaking day and night all-weather radar bomb runs over simulated targets throughout North America at altitudes between 1,000 and 20,000 ft.

These low-level "Oil Burner" sorties are being flown over seven routes, or corridors, each 20 miles wide and up to 500 miles in length, with the usual notifications. The Federal Aviation Agency, however, has issued special warning notices urging all pilots to watch out for low-level high-speed bombers.

• • •

● At Edinburgh, the club ended November in "a blaze of glory," with four first solos in one week-end, and a particularly cheery party. The month was above average for flying, with only one "lost" week-end, and hours airborne totalling about 25. The Edinburgh club at last boasts a Chipmunk, to augment its Tiger Moths.

● On January 30, the Elstree Flying Club is holding its first Pilots' Dinner, open to all current flying members of the club who are either qualified or student pilots. This informal function is to be held in the Club Dining Room, and the price per person is only 8s. 6d.

● At Kidlington, Mrs. Jan Vigors soloed in a Piper Tri-Pacer after six hours' *ab initio* instruction. Five pilots have now been converted to the Tri-Pacer, including ADF and VOR experience. The Oxford Aeroplane Club has been busy co-operating with its neighbouring gliding and parachuting clubs, and the usual social events were held over the Christmas period.

Gliding Notes

by Dr. A. E. Slater

NEWS about this year's World Gliding Championships come to hand from Germany, is that 60 entries have been received so far, and six more countries, known to intend taking part, have not yet sent their entries. About two-thirds of the entries are in the Standard Class and only one-third in the Open Class. It is not yet known whether four or only three entries will be allowed from each country.

This news is a pat on the back for those who have urged the need for a Standard Class; however, it still seems likely that, of the two champions, the winner in the Open Class will be regarded by the gliding fraternity as the World's top glider pilot.

Having seen in a Dutch paper that the Championships will be held at Keulen, I passed on the information in these notes; but it now appears that Keulen is merely Dutch for Köln, which is German for Cologne, which is French for Colonia, its original Latin name. The site of the meeting is Butzweilerhof airfield, two kilometres N.W. of the above-mentioned city.

• • •

TWO British pilots—both Goodharts—now have all three Diamonds to add to their Gold "C" badges. Nicholas obtained No. 42 in the international list, and since completing the flights in the United States he has made flights in England which would likewise have qualified.

Tony Goodhart secured his last Diamond in France on January 2 with a climb of 5,000 m. in a flight from Issoire, in the Massif Central, near Clermont Ferrand. Flying an Air-100, he had already climbed 10,000 ft. in a wave and was still going up at 10 ft./sec. when a cold front of the squall-line type came through and greatly improved the wave.

He had been climbing in clear air in front of a turbulent cloud mass formed in the first upward rebound to leeward of the mountain range; but the cold-front cloud whose base was at 4,000 ft., then enveloped him, and inside it he rose to 20,000 ft. He then drifted to leeward into the sink, so charged upwind and soon emerged into clear air. Up he went again to 25,000 ft., but, though still rising at 5 ft./sec., he had to leave the lift at that height as his rather meagre oxygen supply had given out (shortage was due to the holiday period).

While this was going on, a Dutch pilot, J. Jungblut, went up to 25,000 ft. and down again in less than an hour, setting up a national height record for his country.

• • •

LONDON GLIDING CLUB has put up a record annual total of 3,303 hours for 1959, with 14,504 launches, including 856 aero-tows. June, July and August were all record months, each beating the one before. There were 254 flying days, and soaring was done on 160 of them.

Cross-country flights numbered 135, covering 8,392 miles, and pins on the map show the favoured direction to have been south-westerly, the half-dozen longest flights being 300 km. to Plymouth. North-easterly flights came next in favour, but there were no long distances to north or south. It would be just over 500 km. to Portmoak.

The Royal Air Forces Association Gliding Club, already mentioned in these notes, started officially on January 1 at Podington airfield with the co-operation of the Northamptonshire Gliding Club, whose facilities and equipment it will use.

Precelly Gliding Club in Pembrokeshire, which made a rather abortive start two years ago, has come to life again in a less informal set-up. Work on the launching equipment was completed and test flying began in September last. Annual subscriptions vary from £6 6s. for full membership down to 5s. associate membership for "juniors still at school." The secretary is John Williams, Brodawel, Crymmych, Pemb.

• • •

TWO good wave flights have so far been reported from the "Wave Safari" held at the Midland Club after Christmas. Ted Stark, who organized the meeting for the Army Gliding Association, reached 6,000 ft. after an aero-tow from Shawbury on Dec. 28; and J. van Eck, a visitor from Holland, reached 7,600 ft. from the Long Mynd on Dec. 30 during the first slope-soaring flight of his life.

• • •

AT the Kronfeld Club (74 Eccleston Square, near Victoria) Ann Welch is giving a course of lectures for gliding instructors and trainee instructors on Mondays, Jan. 25 and Feb. 1, 8 and 22, at 19.30 hr. Particulars from the British Gliding Association.

On Jan. 20 at the same Club, R. M. Charles of English Electric is to talk on "Flying From 1914 On."

Another course of lectures of interest to gliding people is on "Hail and Hail Prevention," which Frank Ludham is giving at Imperial College Met. Dept. (Huxley Building, opposite the Science Museum in Exhibition Road) at 18.45 on six Thursdays beginning Feb. 11. Tickets can be got at the lecture room.

• • •

A NEW aviation "barrier," specially for sailplanes, has been established by Dr. August Raspet in a paper read at the Technical Symposium held by the Soaring Society of America at Los Angeles last September, and reprinted in *Soaring*. It is the "40 to 1" barrier, this being the best gliding angle attainable by present techniques such as laminar flow and drastic reduction of parasite drag.

Gigantic spans and enormous aspect ratios would only lead to a small improvement, Dr. Raspet says. But he points out that when the sun shines on to the upper surface of a wing, there is 0.2 h.p. of solar energy waiting to be collected from each square foot. But how?

Solar cells, he suggests. If they covered 140 sq. ft. of wing surface, they could deliver 1,000 watts of electrical energy, and if this is used to drive a propeller with 70% efficiency, a little less than 1 h.p. would be available. The plastic sailplane Phoenix, which Raspet is at present investigating at Mississippi State University Aerophysics Dept., would thereby have its gliding ratio improved from 40 to 93.5.

This would be useful for slow flying in thermals, but for high-speed glides between thermals the solar energy would be better used for boundary-layer control, to improve "penetration"; the Phoenix, cruising at 100 m.p.h., could achieve full laminar flow by using 0.6 h.p. for suction. Incidentally, human muscle power, according to expert opinion, could provide half a horse-power for long periods.

Atmospheric turbulence is another source of power which Raspet believes to be usable—in fact, on a typically turbulent day, it could theoretically maintain a sailplane in level flight.

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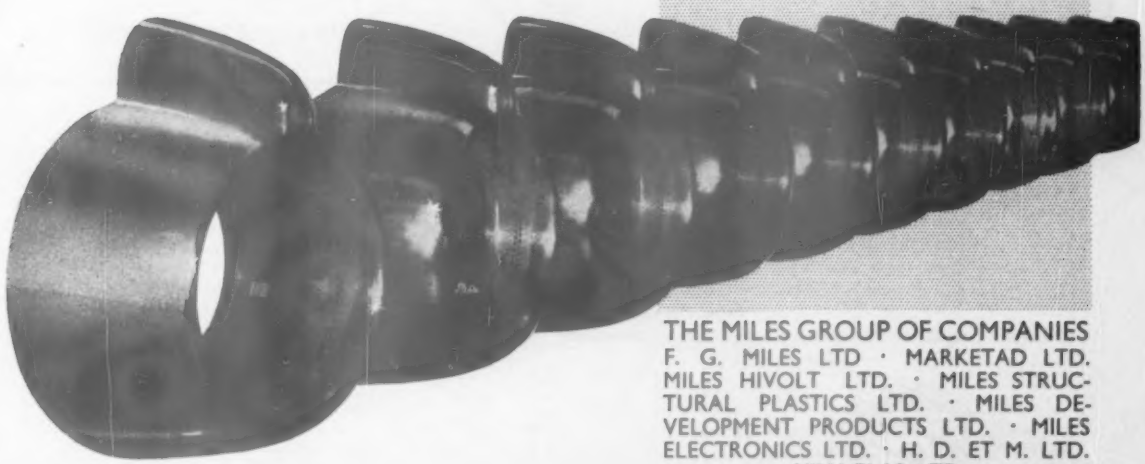

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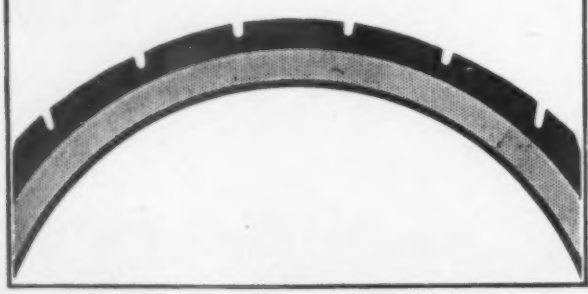

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The Goodyear Tyre & Rubber Co. (G.B.) Ltd., Aviation Products Division: 8-9 Salop Street, Wolverhampton. Tel.: Wolverhampton 27727. Airline Sales & Service, Viscount Way, London Airport, Hounslow, Middx. Tel: SKYport 1922.

GOODYEAR AVIATION DIVISION

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Correspondence

Bring Back the Big Boats

THE best way for this country of ours to forget its debt to the lordly Sunderland is to fossilize one in a museum. I admire Peter Thomas' idea very much (December 25), but isn't it based on nostalgia and not on what is reasonably practical?

He's all right for my quid. I look back on my time in 210 Squadron with a growing realization that I was in on something really dramatic. I know that those who went down to the sea in the big boats will not forget what Gp. Capt. Coates once called "the deep-water feeling." A fine term this . . . one that indicates how dependent we are on the sea in this island of ours.

Bring back the big boats! Questions of tactical advantage cannot be bigger than morale. There is an awful feeling abroad these days that the R.A.F. is becoming a closed fist holding a rocket instead of an outflung hand sending winged envoys to every part of the World. Heraldic or not, I know which of these allegories has the greater appeal.

Flying-boats ensure the existence of arts, crafts and skills the Service is poorer without.

Llantwit-Major, Glam. ISLWYN WILLIAMS. R.A.F. (Retd.).

Gyroplane, Autogiro or Autogyro

AN aircraft, whose main supporting surface consists of a freely rotating windmill, is variously described in current journals and literature as a gyroplane, autogiro or autogyro. In particular, the word autogyro was frequently used in the issue of THE AEROPLANE AND ASTRONAUTICS dated December 11 which was a special issue devoted to rotorcraft, and likewise elsewhere since. This may be accordingly a good time to attempt to standardize what is the correct term to use.

Some American dictionaries define autogyro and gyroplane in the same terms without drawing attention to the dual use. British dictionaries are careful in stating that Autogiro is, or was, a trade name. The Aeronautical Glossary of the British Standards Institution comes down firmly by defining gyroplane and omitting any reference to the other two terms.

The present writer was involved in some of the correspondence which was exchanged with Cierva on this subject during his lifetime. It was then agreed that Autogiro was a trade name to which his company had the sole right. Concurrently, he took exception to autogyro, which was merely another spelling of his trade name and with this contention the British Air Ministry of that date agreed. Consequently, the alternative of gyroplane was adopted by the Ministry and its use confirmed by publication in the next and subsequent B.S.I. glossaries.

It is hoped, therefore, that in this country, which had such close and cordial contacts with Senor de la Cierva, we will use the correct noun—gyroplane—and leave to the credit of that remarkable and charming inventor his trade name of Autogiro (autogyro). This might not, however, exclude the word autogiro as an adjective in expressions such as "autogiro" concept for a VTOL aircraft, but even in such an instance the word gyroplane seems equally applicable.

Claygate, Surrey. J. L. NAYLER.

By a Pilot for Pilots

WHILE appreciating that John Fricker had to stop somewhere in his Pilot's Selection of Aviation's Ten Best Books (A. and A., December 25), I was surprised by his omission of P. G. "Bill" (now Sir Gordon) Taylor, who flew with "Smithy," Ulm, "Scotty" Allan and others and, since the War, has made several meritorious flights on his own account.

"Bill" Taylor is one of the few great aviators who is equally gifted as a writer. For my money, there are no more satisfying and moving books about our beloved aviation than the seven or eight which he has written, among them "Pacific Flight," "VH-UXX" and "Frigate Bird."

Worcester Park, Surrey. E. A. CHRIS WREN.

Great Britain and Astronautical Research

I SHOULD like to amplify and reinforce Mr. Gatland's cogent arguments in favour of a worth-while British contribution to astronautics, as expressed in THE AEROPLANE AND ASTRONAUTICS for December 18 last.

In the first place, while I agree with the view of the Advisory Council on Scientific Policy, that astronautics should be tackled as a co-operative endeavour by all nations, I am profoundly surprised that the A.C.S.P. makes no specific recommendation for the formation of a Commonwealth Astronautical Consortium. Such a Consortium would include the following advantages:—

1. It would be an immediate major step, such as no other country can take, towards internationalizing astronautics and spreading the cost.
2. It would permit the mounting of an astronautical programme worthy of our position in World affairs and capable of redressing the balance of power.
3. It would unite the peoples of the Commonwealth—white and coloured—in an enterprise which affords unique opportunities for the co-operative development of academic, technological and industrial facilities that are at present lamentably and dangerously lacking.

I think that items 2 and 3, at least, are matters which upon full consideration cannot be ignored by the statesmen of this country and the rest of the Commonwealth.

Beaconsfield, Bucks. H. E. Ross, F.B.I.S.

Groundabout

No Stuffiness. A friend was talking at home of Prince Philip's commendable preference for travelling on the flight deck rather than in the cabin. "Ah, yes," said my friend's mother-in-law, "he's a rare one for the fresh air."

*

Honorary and honorable. In case my recent drawing about Col. R. L. "Mossy" Preston should have misled you, he is *not* retiring from the Secretary-Generalship of the Royal Aero Club. He is continuing very generously in an honorary capacity to work for the good of the Club and personal flying.

*

Amalgamated Christmas and a Rational New Year. At the R.Ae.C. dinner to "Mossy" on December 16. Sir Tom Sopwith was heard to say to Sir Roy Dobson, "Hallo, Dobby, finished your Christmas shopping?"

*

Christmas Cracker

Q.: Why does the Vickers VC-10 have its engines at the back instead of in front?

A.: What else would you expect? Vicars always wear their collars back to front!

*

Noise Breakthrough. Reporting a Boeing 707 tail-down take-off test required by A.R.B., a journal says: "The test apparently showed that the aircraft would only unstick when the noise was lowered." I thought it was the noise which made it get off at all.

*

In the Direction of Down. From a newspaper report: "There is a moment in the landing approach when the speed of the Boeing 707 must be brought down sharply and pilots who are flying them say that this takes considerable skill and experience." A novice friend remarks that he has little skill and experience but is able to lose flying speed at any time; his difficulty is to lose it at the best point in his private position/time sequence.

*

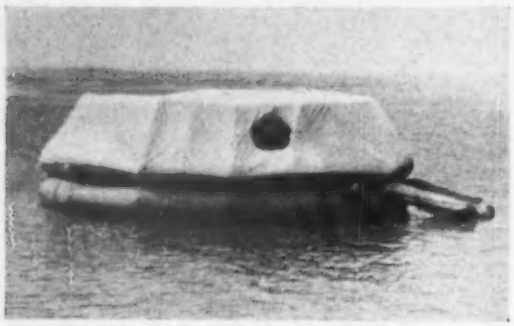
Grist to the Mill. I will swear that some publicity people write with this column in mind. How else can you account for such a statement as "Britannia captain Flt. Lt. Harry Liddell made a surprise call shortly after landing on his father, Oxford don Professor E. G. T. Liddell."

*

"Brother, this is something like a cross-wind landing!"

by Lorenzo

NOTES AND EVENTS



AIR-SEA RESCUE.—Safety equipment carried by Qantas 707s includes the type 26V reversible liferaft and the Mark 8 (twin chamber) lifejacket manufactured by Beaufort (Air-Sea) Equipment Ltd., of Birkenhead. The airline has started sea exercises in conjunction with the R.A.A.F. using a 26V liferaft (left) for aircrew training.

STEAM RADIO.—The Standard Telephones and Cables C.A.D.F. (Commutated Antenna Direction Finder) aerial on the forward starboard side of the flight deck of the carrier "Hermes" is believed to be the only steam radio really in existence. It is kept free of ice by steam heating. The aerial array comprises 12 unipoles mounted on a 7-ft. 6-in. ground plate and is for UHF operation.

707 SECONDARY RADAR.—All B.O.A.C. 707s are to be fitted with Cossor airborne transponders. This equipment comprises transponder type SSR.1251, control unit type SSR.1252 and aerial type SSR.1253. These units have been designed to meet the requirements of the A.T.C. system recommended by ICAO, including sidelobe suppression. The transponder is contained in a long ½-ATR case and weighs approximately 21 lb.

SOLARTRON FINANCE. — The agreement to acquire a 53.125% interest in the Solartron Electronic Group, Ltd., Thames Ditton, Surrey, by Firth Cleveland, Ltd., Stornoway House, Cleveland Row, S.W.1, will provide £900,000 immediately to ensure the adequate financing of Solartron's next five-year period of development and expansion. Firth Cleveland will subscribe for 300,000 new ordinary shares of 10s. each at £3 per share.

DOPPLER NAVIGATION.—Canadian Marconi Doppler equipment (ARINC version) recently completed 2,000 flying hours in Boeing 707s on trans-oceanic services with major airlines. Over very smooth water, contact with the surface was maintained from 42,000 ft. for more than 98% of the flight time. The periods during which the equipment functioned in the special smooth sea mode were relatively short and the overall accuracy has been reported as being better than 0.5% of the distance flown.

HUNTING NAME CHANGES.—In order to simplify and streamline the structure of certain British and Canadian companies in the Hunting Survey Group, a number of changes have been made. In the U.K. the activities of Hunting Geophysics, Ltd., have been merged with those of Hunting Aerosurveys, Ltd., to form Hunting Surveys, Ltd. In Canada, the Photographic Survey Corpn., Ltd., Hunting Airborne Geophysics, Ltd., and Hunting Technical and Exploration Services, Ltd., have been combined under the name of Hunting Survey Corpn., Ltd.

INSTITUTE OF METALS. — The Prime Minister is to be the principal guest and speaker at the annual dinner of the Institute of Metals which is to be held in Grosvenor House, London, on March 31. The U.S. Ambassador has accepted to reply for the guests.

ELECTRICAL SHOW.—The ninth National Electrical Engineers Exhibition will be held at Earls Court, London, between April 5 and 9, 1960. One of the main features will be devoted to electrical and electronic equipment, including control, navigational and communications units, installed in the carriers "Victorious" and "Hermes."

ESSO PIPELINE. — A large-scale pipeline is being planned by the Esso Petroleum Co., Ltd., to run from its refinery at Fawley to a new distribution depot near London Airport. The cost of the project will be £2½ million. Aviation fuels will be pumped by separate pipelines from the depot to the airport.

Aviation Calendar

January 16.—British Interplanetary Society Schools lecture, "The Scientific Exploration of Space," by Dr. N. H. Langton, in the Hoare Memorial Hall, Church House, **London,** S.W.1, at 15.00 hrs.

January 18.—Institution of Production Engineers North Midlands Region lecture, "Production of the A.W.A. Argosy Aircraft," by R. A. Courtman, in the Louis Room, St. James's Restaurant, St. James Street, **Derby,** at 19.00 hrs.

January 18.—R.Ae.S. Derby Branch Annual General Meeting and Film Show, in the Rolls-Royce Welfare Hall, Nightingale Road, **Derby,** at 18.15 hrs.

January 18.—R.Ae.S. Halton Branch lecture, "Aircraft Carriers" by J. C. Lawrence, at Branch H.Q., **R.A.F. Halton,** at 18.45 hrs.

January 19.—R.Ae.S. lecture, "Some Aerodynamic Problems of Engine Installation," by Dr. J. Seddon, in the Library, 4 Hamilton Place, **London,** W.1, at 19.00 hrs.

January 19.—R.Ae.S. Glasgow Branch lecture, "Development of the Olympus Turbojet," by E. Mosedale, at the Royal College of Science and Technology, **Glasgow,** at 19.15 hrs.

January 20.—R.Ae.S. Bristol Branch lecture, "Space Medicine," by Wg. Cdr. P. D. C. V. Wittingham, at Filton House, **Bristol,** at 18.00 hrs.

January 20.—R.Ae.S. Brough Branch Young People's Christmas lecture, "Flying with the Trans-Antarctic Expedition," by Wg. Cdr. J. H. Lewis in the Newland High School, **Hull.**

January 20.—R.Ae.S. Coventry Branch lecture, "Transport Command," by Gp. Capt. F. C. Griffiths, in the Herbert Art Gallery, **Coventry,** at 19.30 hrs.

January 20.—R.Ae.S. Preston Branch lecture, "Aircraft Structural Testing," by H. C. Channon, at the Queen's Hotel, **Lytham,** at 19.45 hrs.

January 20.—R.Ae.S. Reading Branch lecture, "Airline Routeing," by A. Williams in the Top Canteen, Western Manufacturing (Reading), Ltd., **Reading,** at 18.00 hrs.

January 21.—R.Ae.S. Cambridge Branch Main Lecture, "Research at the College of Aeronautics," by Prof. A. J. Murphy in the No. 1 Lecture Hall, Engineering Laboratories, **Cambridge University,** at 20.15 hrs.

January 21.—R.Ae.S. Isle of Wight Branch lecture, "Aircraft Production," by A. Vines in the Clubhouse, Saunders-Roe Sports and Social Club, Church Path, **E. Cowes,** at 18.00 hrs.

Company Notices

New Patents

APPLICATIONS ACCEPTED

827,870.—De Havilland Engine Co., Ltd.—"Pressurized gas supply from gas turbine engines."—Aug. 28, 1957. (Sept. 3, 1956.)

827,852.—Fairey Aviation Co., Ltd.—"Helicopters." Oct. 16, 1956. (Nov. 11, 1955.)

827,812.—Borgs Fabriks A.G.—"Arresting means for retarding aeroplanes and other vehicles."—March 13, 1958.

827,744.—Soc. Nationale d'Etude et de Construction de Moteurs d'Aviation.—"Apparatus for deflecting a gaseous stream flowing through an annular structure of an aircraft or aircraft engine."—July 6, 1956. (July 12, 1955.)

Applications open to public inspection on February 10, 1960. Opposition period expires on May 10, 1960.

828,785.—Sperry Gyroscope Co., Ltd.—"Control apparatus for aircraft."—Sept. 27, 1957.

828,786.—Sperry Gyroscope Co., Ltd.—"Control apparatus for aircraft."—Sept. 27, 1957 (Divided out of 828,785.)

828,884.—Boulton Paul Aircraft, Ltd.—"Aircraft." Mar. 21, 1956. (Dec. 21, 1954.)

828,885.—Boulton Paul Aircraft, Ltd.—"Aircraft." April 12, 1956. (April 15, 1955.)

829,076.—Czerwinski, W.—"Pipe coupling."—July 31, 1958. (Aug. 15, 1957.)

829,100.—Plessey Co., Ltd.—"Ram air turbine driven auxiliary power generators."—April 17, 1957. (Jan. 17, 1956.)

Printed specifications of the above will be available on February 24, 1960, and the opposition period will expire on May 24, 1960.

INCREASES OF CAPITAL

Blackburn Aircraft, Ltd. (624,347), Brough, Yorkshire.—Increased by £999,000 in 1,999,800 ordinary shs. of 10s. beyond reg. cap. of £100.

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Birth Notices

Archer.—On December 30, to Valda (*née* Smart), wife of Wg. Cdr. H. D. Archer, of R.A.F. Colerne—a daughter.

Beavis.—On January 1, at R.A.F. Hospital, Nocton Hall, Lincs, to Joy, wife of Sqn. Ldr. M. G. Beavis—a son.

Campbell.—On January 1, at Mill House, Naunton, nr. Cheltenham, to Stella (*née* Stephens), wife of Flt. Lt. D. H. Campbell—a son.

Davies.—On December 21, at Alexandra Maternity Home, Plymouth, to Ann (*née* O'Connor), wife of Flt. Lt. W. J. Davies—a daughter.

Eley.—On January 2, at Leanchoil Hospital, Forres, to Rosemary, wife of Flt. Lt. A. J. Eley, D.F.C.—a son.

Fleming.—On December 28, at R.A.F. Hospital, Wegberg, to Cynthia (*née* Hume), wife of Flt. Lt. P. C. H. Fleming—a son.

Jolly.—On January 2, at Oakham Hospital, to Louise, wife of Sqn. Ldr. J. D. Jolly—a son.

Milligan.—On December 31, at R.A.F. Hospital, Ely, to Doreen, wife of Sqn. Ldr. J. Milligan—a daughter.

Price.—On December 31 at Cheltenham Maternity Hospital, to Pamela (*née* Teakle), wife of Wg. Cdr. C. F. Price—a son.

Wilson.—On December 31, at Newcastle General Hospital, to Marjorie (*née* Wirth), wife of Sqn. Ldr. R. K. Wilson, A.F.C.—a son.

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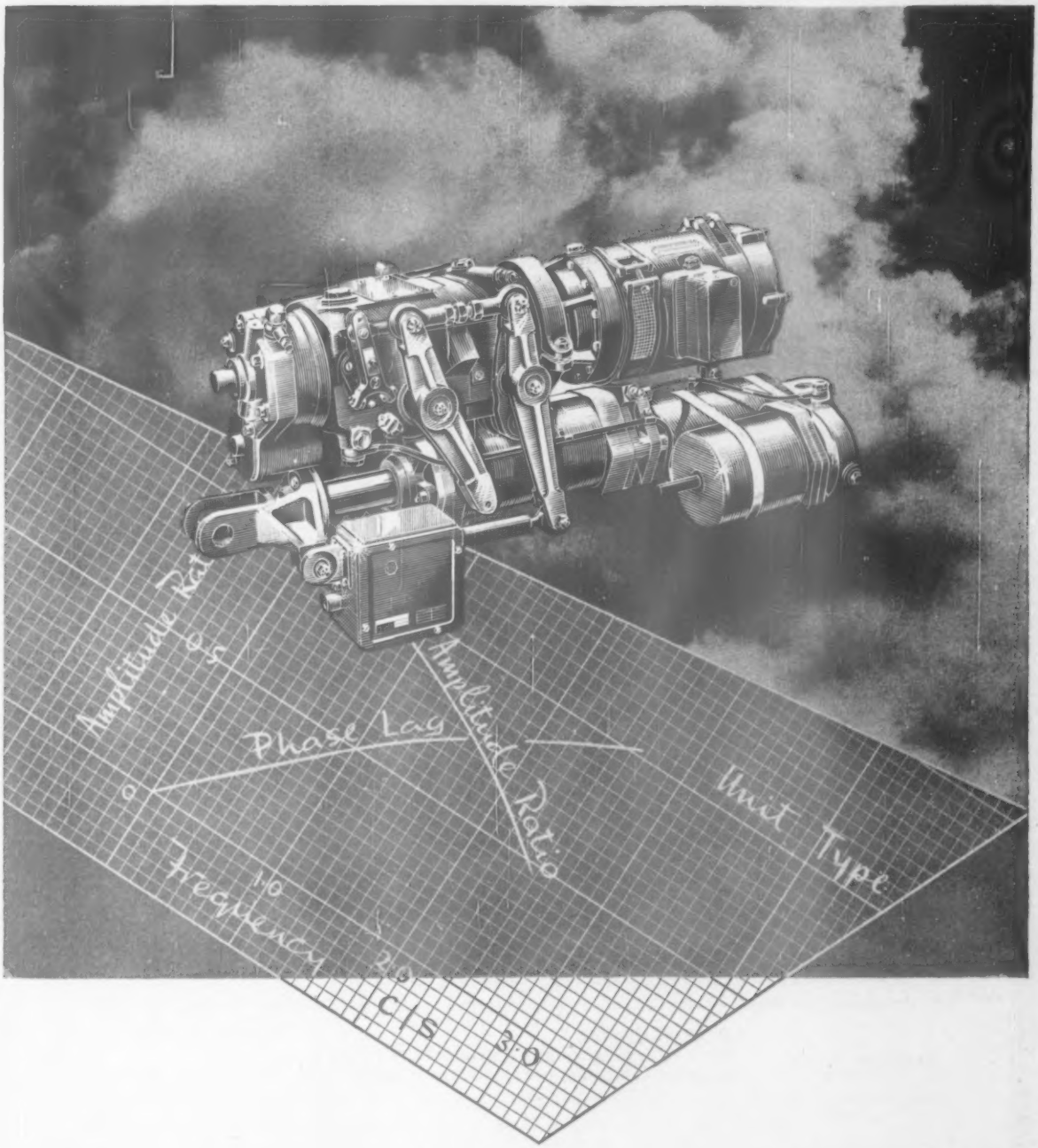

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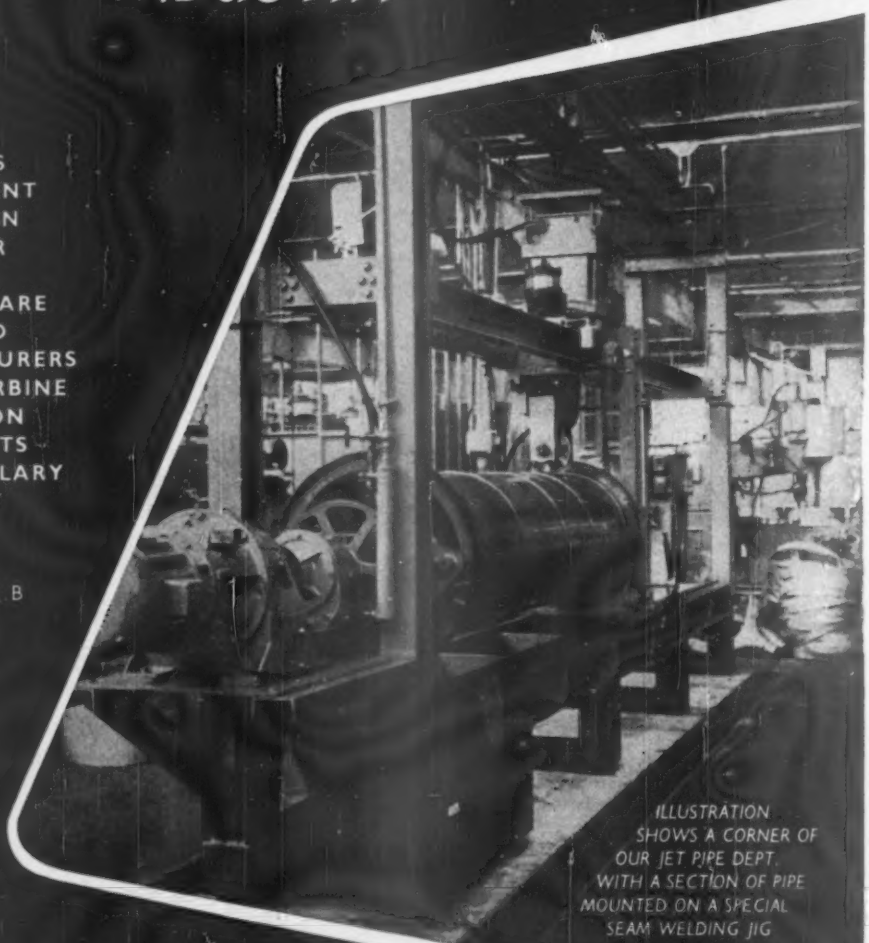

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(c) APPLICATION NO. 3357 for a U.K. Internal Service between London (Gatwick) and Bournemouth at an initial frequency of two return flights weekly increasing later to two return flights daily.

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APPLICATION NO. 3364 on the route Carlisle (Crosby)-Guernsey and/or Jersey.

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APPLICATION NO. 3366 on the route Carlisle (Crosby)-Derby (opt.)-London Airport.

FROM BRITISH EUROPEAN AIRWAYS CORPORATION, OF BEALINE HOUSE, RUISLIP, MIDDX:—

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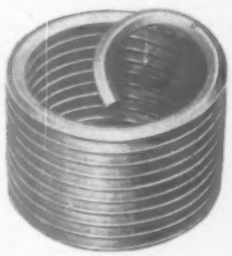

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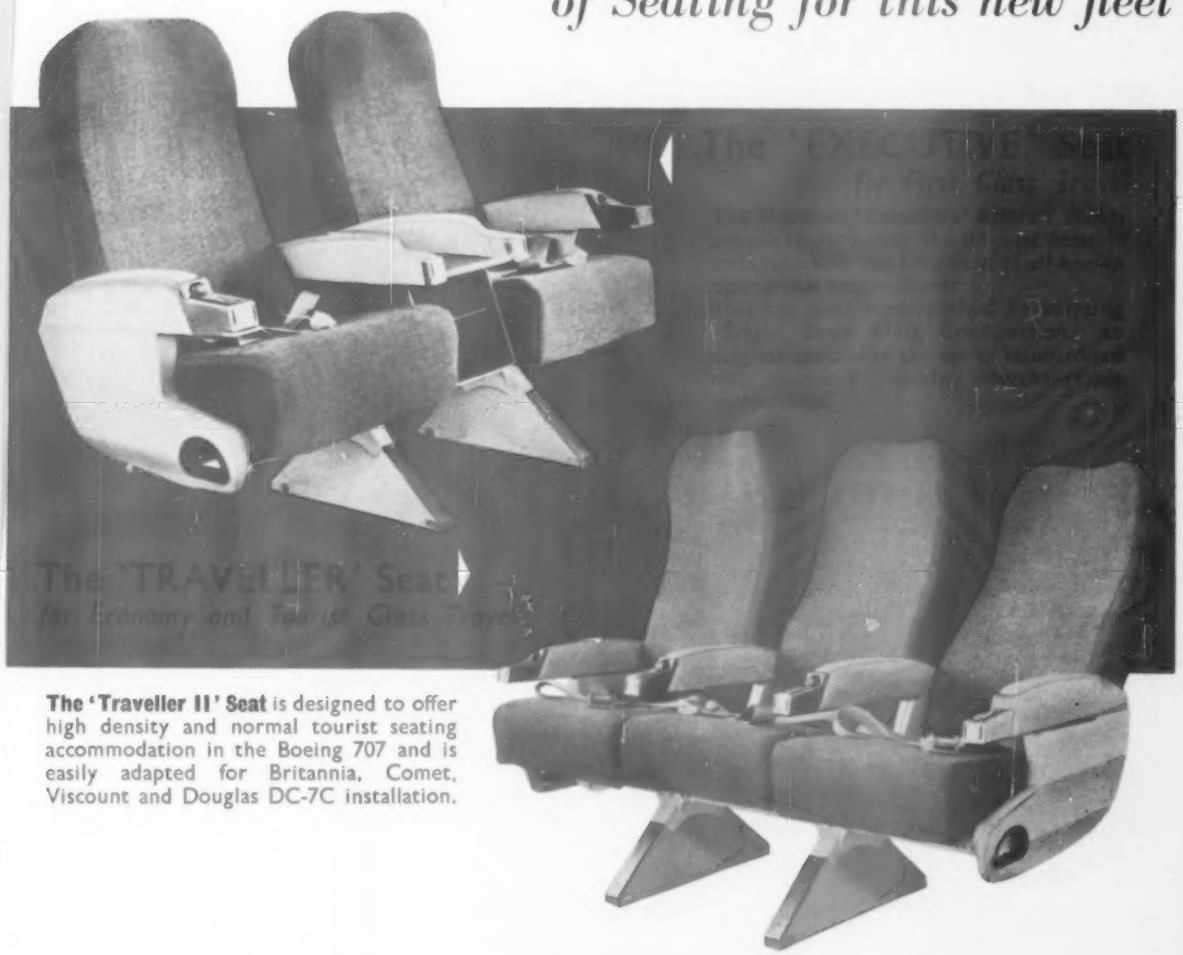

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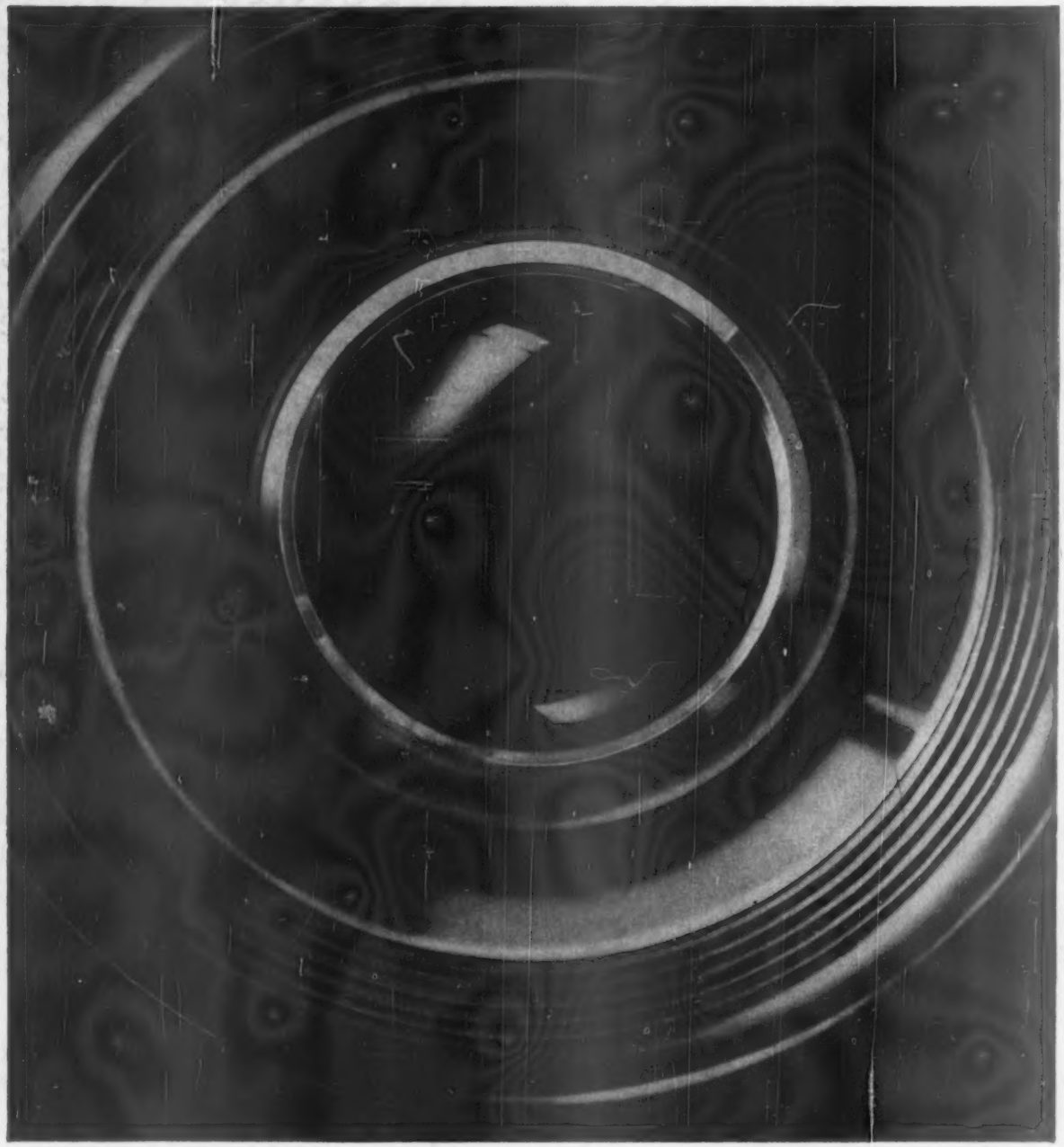

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